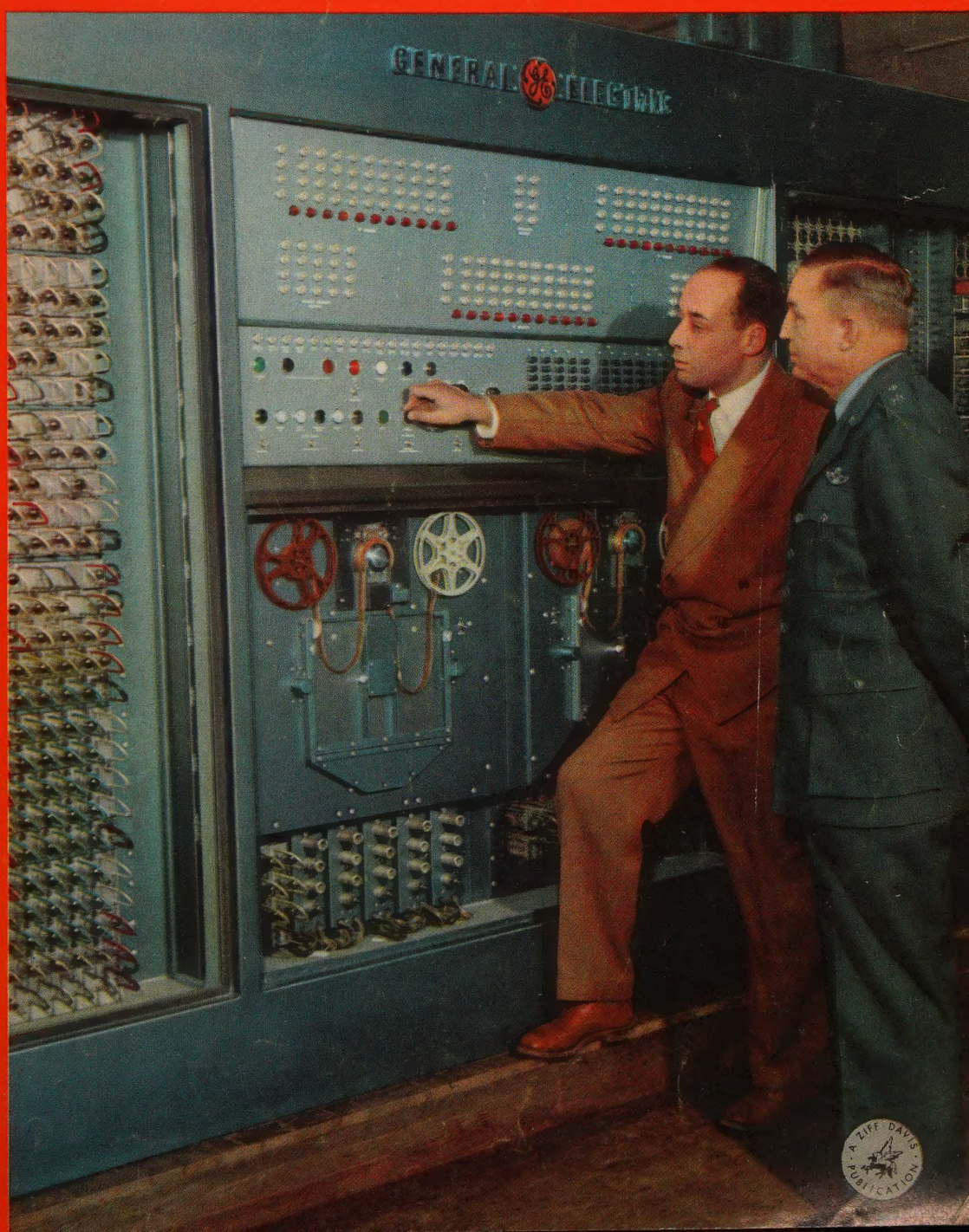
IO-ELECTRONIC ENGINEERING EDITION

RADIO & TELEVISION NEWS

OCTOBER
1953



Have you hung up

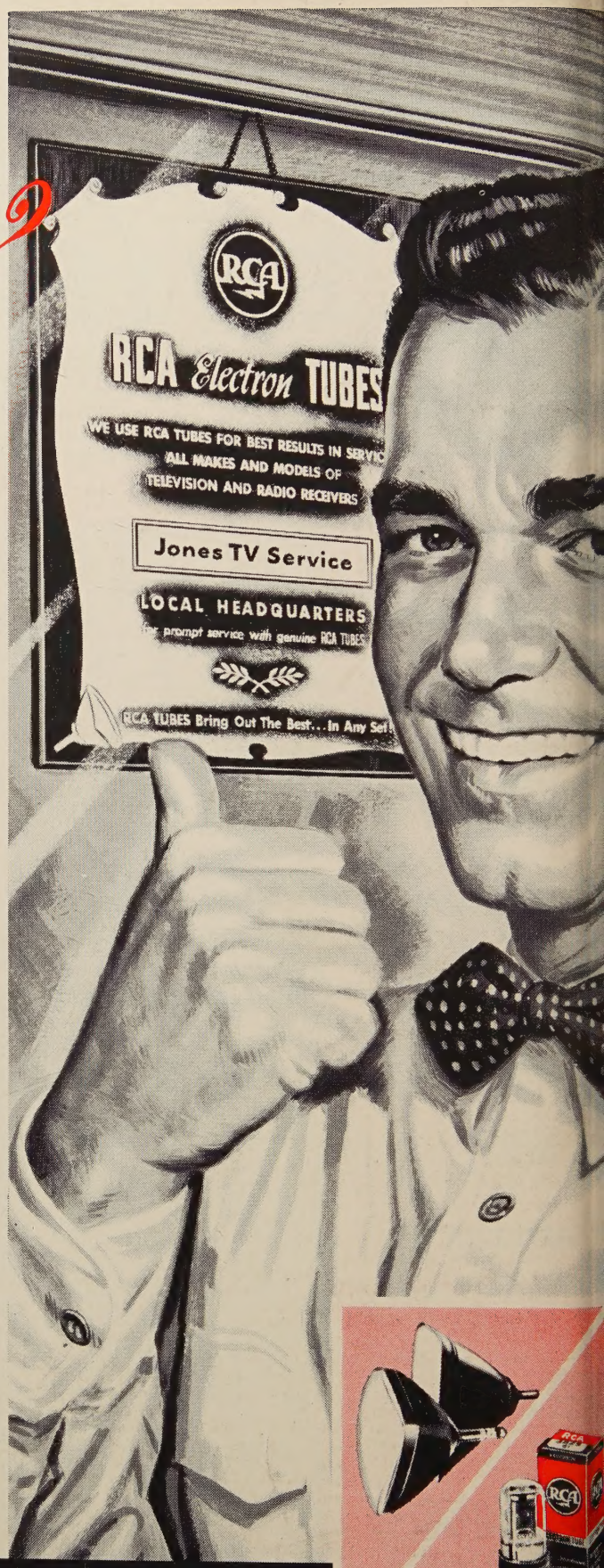
your shingle?

IT PAYS TO KEEP GOOD COMPANY . . . and it's good business to advertise the good company you keep.

Thousands of dealers and servicemen are using the sales-magic in the RCA name to instill confidence in their customers. Identifying *your* name with RCA pays off in dollars and cents.

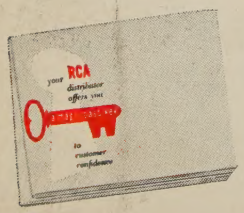
And it's so easy to do . . . because RCA's new Dealer Identification Program provides you with a handsome "shingle" with your name on it, that you'll be proud to display in your shop. When a customer sees this Dealer Identification Plaque he *knows* you are using the best tube products available.

So, we ask . . ."Have you hung up *your* shingle yet?" If not, be sure to see your **RCA Tube Distributor** today and learn how *you* can qualify for a Registered Dealer Plaque at no extra cost.



Unlock the door to bigger profits

Here's *your* key to better business . . . RCA's dynamic Dealer Identification Program. Ask your *RCA Tube Distributor* for your copy of the colorful, 16-page booklet "A Magic Pass-Key to Customer Confidence." It tells you how — for the first time—you can become a Registered Dealer . . . and get *extra* sales benefits.



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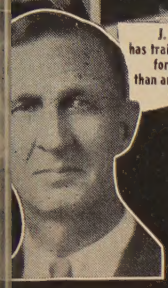
RADIO CORPORATION of AMERICA
ELECTRON TUBES
HARRISON, N. J.

You Practice Broadcasting with Parts I Send

As part of my Communications Course I send you kits of parts to build the low-power Broadcasting Transmitter shown at left. You use it to get practical experience putting this station "on the air," performing procedures demanded of broadcasting station operators. Training plus opportunity is the PERFECT COMBINATION for job security, good pay, advancement. An FCC Commercial Operator's License can be your ticket to a better job and a bright future and my Communications Course gives you the training you need to get your license. Mail coupon below and see in my book other valuable equipment you build. All equipment I send is yours to keep.

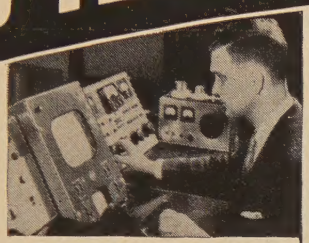


J. E. Smith has trained more men for Radio-TV than any other man

You Practice Servicing with Parts I Send

Nothing takes the place of PRACTICAL EXPERIENCE. That's why NRI training is based on LEARNING BY DOING. You use parts I furnish to build many circuits common to both Radio and Television. With my Servicing Course you build the modern Radio shown at left. You build an electronic Multitester which you use to help fix sets while training at home. Many students make $10, $15 a week extra fixing neighbors' sets in spare time, starting soon after enrolling. I send you special booklets that show you how. Mail coupon for my big 64-page book and actual Servicing Lesson, both FREE. See other equipment you build and keep.

I Will Train You at Home to be a RADIO-TELEVISION Technician



TELEVISION
Today's Good Job Maker

now reaches from coast-to-coast. Over 25 million TV sets are now use; about 200 TV stations are on the air; hundreds more being built. is means more jobs, good pay jobs with bright futures. Now is the e to get ready for success in TV. Find out what Radio-Television ers you. Mail coupon now for my 2 Books FREE!

America's Fast Growing Industry Offers You Good Pay, Success

Do you want a good pay job, a bright future, security? Then get into the fast growing RADIO-TELEVISION industry. Hundreds I've trained are successful RADIO-TELEVISION TECHNICIANS. Most had no previous experience, many no more than grammar school education. Keep your job while training at home. Learn RADIO-TELEVISION principles from easy-to-understand lessons. Get practical experience on actual equipment you build with parts I send you.

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Mail Coupon — Find Out What Radio-TV Offers You

Send for my FREE DOUBLE OFFER. Cut out and mail coupon below. Send in envelope or paste on postal. You will get actual Servicing Lesson to prove it's practical to learn at home. You'll also receive my 64-page Book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning, see photos of equipment you practice with at home. J. E. Smith, President, Dept. 3KE National Radio Institute, Washington 9, D. C.

I TRAINED THESE MEN

Has Growing Business

"I am becoming an expert Teletrician as well as Radiotrician. Without your practical course I feel this would have been impossi- My business continues to grow." ilip G. Brogan, Louisville, Ky.

Good Job with Station

m Broadcast Engineer VLPM. Another tech- an and I have opened adio-TV service shop r spare time. Big TV s here. As a result we have more t than we can handle." — J. H. gley, Jr., Suffolk, Va.

raises NRI as Best Course

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National Radio Institute, Washington 9, D. C.

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City..... Zone..... State.....

VETS write in date of discharge.....

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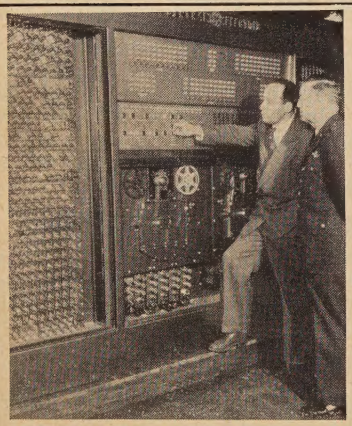

COVER PHOTO: Brig. Gen. Leighton I. Davis, director of armament for the U.S. Air Force Air Research & Development Command, inspects the General Electric digital computer, OARAC, with C. R. Wayne, a G-E computer engineer. (Ektachrome by J. Frano)

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OCTOBER, 195

DEPARTMENTS

ZIFF-DAVIS PUBLISHING COMPANY
Editorial and Executive Offices
366 Madison Ave., New York 17, N. Y.
VOLUME 50 • NUMBER 4

Member
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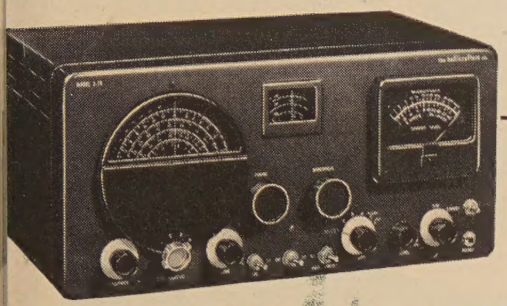
Circulations

Check the specs...

Check performance...

Then, They'll Choose Hallicrafters



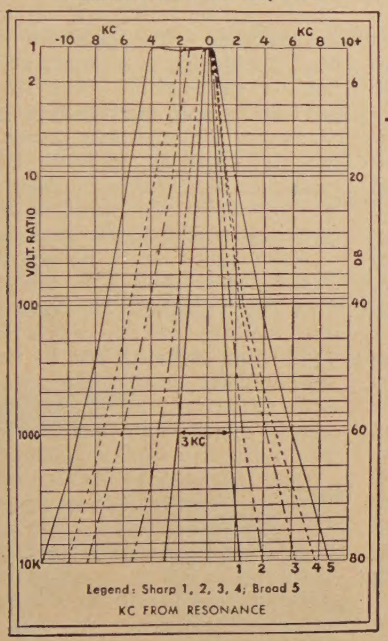
Model S-76

Double conversion receiver. Broadcast Band 538-1580 kc plus three short-wave bands covering 1720 kc-34 Mc.

Calibrated electrical bandspread for easy tuning. Double superhet with 50 kc second i-f and giant 4-inch "S" meter. Five position selectivity, one r-f, two conversion, two i-f stages, temperature compensated. 3.2 or 500 ohm outputs.

Satin black steel cabinet. 18½" x 8⅞" x 9½" deep. Nine tubes, voltage regulator, and rectifier. For 105/125 V. 50/60 cycle AC. Use R-46 speaker. . . **$199.95**

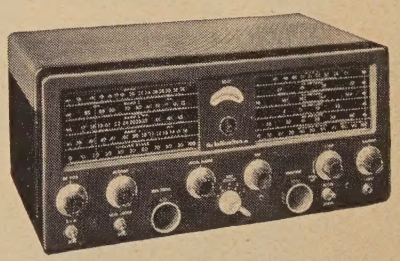
SELECTIVITY CURVES, S-76



Do you know any better way, any other way, to judge SW equipment than to check the specifications and the performance? Frankly that's the only valid way we can think of to make sure you get your money's worth. Check these specs. Take a look at the selectivity curve for the S-76. It is typical of the outstanding value Hallicrafters offers in every price class.

Model HT-20. T.V.I. suppressed 100 watt AM-CW transmitter with all spurious outputs above 40 Mc at least 90 db. below full rated output.

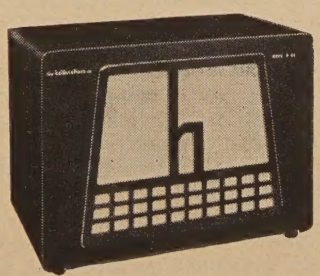
All stages metered; single meter with eight position meter switch; output tuning indication. Frequency range of 1.7 Mc to 31 Mc continuous on front panel control. Seven tubes plus five rectifiers. For 105/125 V. 50/60 cycle **$449.50**



Model SX-71. Covers Broadcast Band 535-1650 kc plus four short-wave bands covering 1650 kc-34 Mc. and 46-56 Mc.

Narrow Band FM one r-f, two conversion, and three i-f stages. Temperature compensated, voltage regulated. Three watt output (terminals for 500 and 3.2 ohms).

Satin black steel cabinet. 18½" x 8⅞" x 12" deep. 11 tubes plus regulator, rectifier. For 105/125 V. 50/60 cycle AC. Use R-46 speaker. **$249.95**



Model R-46. Matching 10" PM speaker for use with Hallicrafters communications receivers SX-71, SX-76, SX-73 or SX-62. 80 to 5000 cycle range. Matching transformer with 500-ohm input. Speaker voice coil impedance, 3.2 ohms.

Satin black steel cabinet matches all Hallicrafters receivers. Cloth covered metal grille. 15" x 10⅞" x 10⅞" deep. Ship. wt. 17 lbs. **$24.95**

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For the RECORD

BY THE EDITOR

HOW MUCH CIRCULATION?

THERE is no business like the publishing business. This theatrical paraphrase is not without point, as you will see. A magazine is successful to the degree that it serves the interests of its readers by providing them with news and information that appeals to the audience for which the publication is edited. Just as it takes a top-flight theater cast to attract full houses for a long run, so does it require editorial excellence to attract and hold circulation.

Circulation is people and people are markets. Through its advertising columns, therefore, the magazine offers advertisers an opportunity to tell readers about goods and services. The value of this opportunity is in keeping with the stability, character, and size of the audience.

Thus it will be seen that the interests of subscribers, advertisers, and publishers are interrelated and interdependent, all centered around the heart of any publishing operation—*CIRCULATION* and RADIO & TELEVISION NEWS has the largest A.B.C. (by many thousands) paid circulation of any magazine in its field.

A key factor in the relations between publishers and advertisers is the manner in which the circulation is reported to advertisers. In order that advertising space may be purchased on the basis of a sound business investment, the circulation of a publication must be substantiated and described in accordance with uniform and accepted standards and terms to permit accurate evaluation (certain radio and TV service publications, please note) and comparison with other media. To accomplish this the Audit Bureau of Circulations was established in 1914. This Bureau, better known as A.B.C., is a voluntary, non-profit, and cooperative association of 3450 advertisers, advertising agencies, and publishers in the United States and Canada. Their first act was to establish a definition for paid circulation, then standards and rules for measuring, auditing, and reporting circulations.

At regular intervals the Bureau's experienced circulation auditors visit all publisher members to audit their circulation records. The information resulting from these audits is issued in A.B.C. reports which are distributed to advertisers and their agencies. These reports answer such questions as "How much circulation?," "Where does it go?," "How was it obtained?"—answers that make it possible for publishers to receive full credit for their circulations and for advertiser to invest their advertising dollars a they buy raw materials and equip ment, on the basis of facts and wel known standards. A.B.C., therefore, a major factor in the integrity of re lations between advertisers and pub lishers. Based on this mutual confi dence, advertisers have appropriate the large amounts for investment i advertising which characterize ou economy and which are recognized a essential in maintaining the ma communications and mass produc tion that are so much a part of ou general welfare.

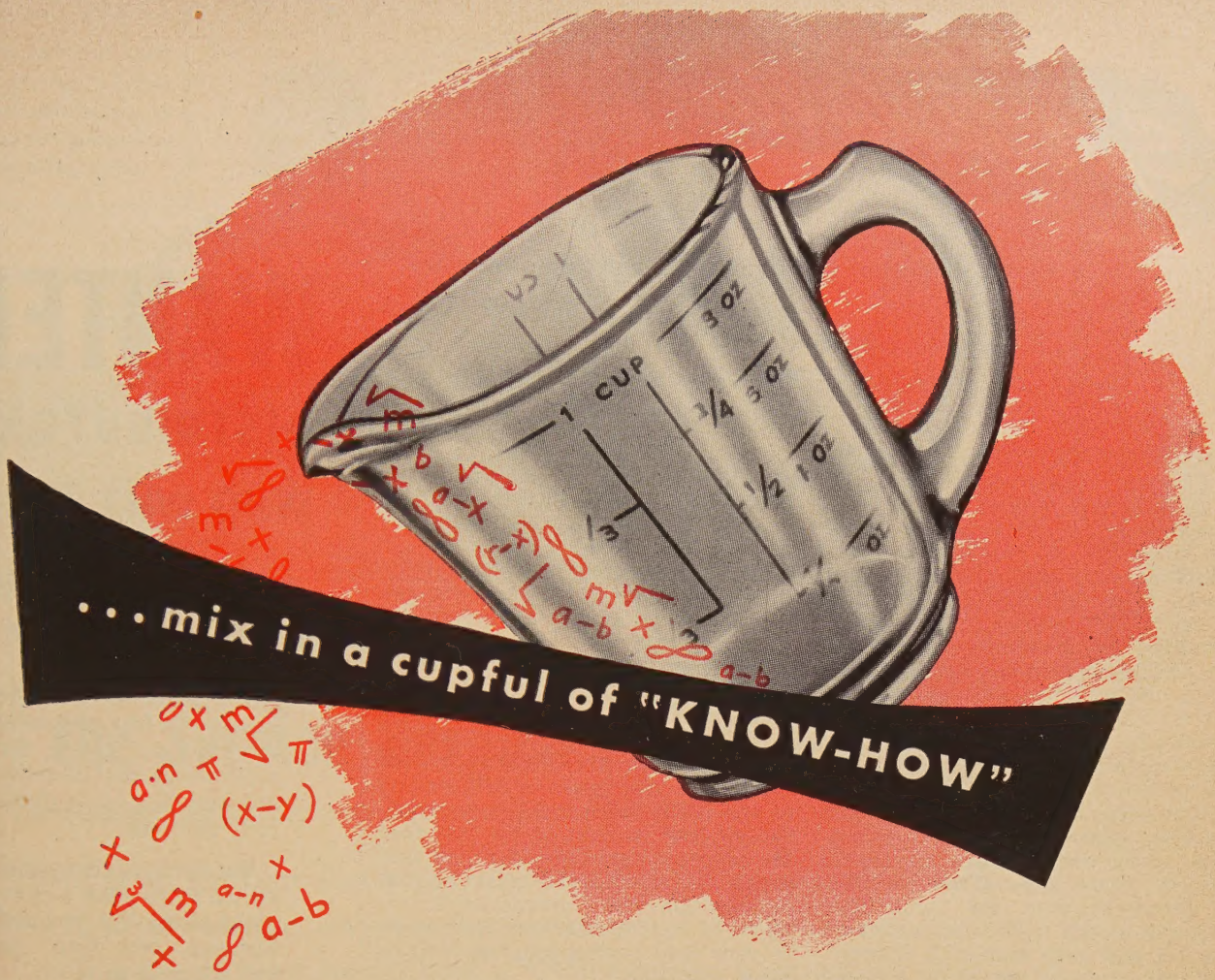
This magazine is a member of A.B.C Our circulation is *known*—not guesse at or claimed! Recognizing the direc benefits of the Bureau's work to pub lishers and advertisers, you will as "What does A.B.C. mean to me, one of your readers?" The answer that you are a customer of ours. Yo paid us good money for your subscri tion. In order to merit your continu patronage, we know that we mus produce a publication of high editori quality. Thus our obligation to yo is also an obligation to ourselves, o that must be fulfilled if we are to sta in business. To maintain and bui our circulation is a constant incenti for us to provide ever-improvin service to you, our readers—the sam incentive that manufacturers and mer chants have in striving always t maintain leadership in their fields, t provide their customers with superi products and superior service.

Much more could be written abou A.B.C.—how it aids in maintaining free press through its contribution t the success of the advertising a publishing industry and as the world outstanding successful example self-regulation in business. This maga zine is proud of its membership in th Audit Bureau of Circulations.

Our 6th annual Audio issue, com ing next month, will include some o the very best articles on audio a hi-fi ever published. This Novembe issue promises to break all previo records for circulation and amount editorial features.

In addition to a wealth of audi material, service technicians and rad amateurs will find a fact-filled secti devoted to their interests. No segmen of our readership has been overlooke in planning the November issue f you.

Incidentally, this special issue w be 50 cents at the newsstands. C regular subscribers receive this "I nus" at no extra charge. . . . O



If knowledge came in containers, almost anyone could pioneer in the design and development of Electron Tubes — might even match RAYTHEON'S remarkable record of achievement in the industry.

But the kind of "know-how" that has helped RAYTHEON achieve so many industry-wide firsts, and established Raytheon Tubes as the quality standards of the industry, comes only through years of dedication to a single objective. For *thirty-years* that objective has been *to make the finest Electron Tubes in the world.* And the precious "know-how" accumulated during this period is now being used to maintain RAYTHEON TUBES' leadership in the years to come.

That's why you can use Raytheon Radio and Television Tubes — today and tomorrow — with complete confidence that you are using the finest. Ask your Raytheon Tube Distributor for them.

RIGHT . . . FOR SOUND AND SIGHT

RAYTHEON MANUFACTURING COMPANY

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CEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

Spot Radio News

★ **Presenting latest information on the Radio Industry.**

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

COMPATIBLE COLOR TELEVISION, a vision, a promise, and a hope for nearly a decade, will at long last become an earthy official reality with the blessings of Washington, and within a matter of but a few months; thanks to an effective petition filed by the NTSC and supporting briefs submitted by members of industry. For the Commission has declared that unless major objections are entered, and at this writing none have been specifically registered, a new color order, replacing the sequential ruling, will be issued.

Even *Columbia,* whose disc system had been approved in '50, has agreed to go along with the new electronic method. There were a few rumbles of discontent with the compatible standards among some manufacturers. One set and tube maker in Chicago said that he would appeal for a hearing to halt approval, because the suggested system did not cover three-dimensional color transmission. Another indicated that since the first runs of color chassis will be costly and beyond the purchasing power of most of the public, the criterion set by the Commission, stipulating that receivers should be moderately priced, has not been met. Neither problem appears to have concerned the Commissioners. The high cost was not looked on as a bar, for in the early days of black and white TV, receivers were far from inexpensive; comparatively speaking they were more costly than the first color sets that will be offered for sale. For not only will there be many more tubes in the red-green-blue chassis, but the picture tube, that is actually three tubes in one, is extremely complex to build.

In Washington and industry, too, it is felt that even if a few dissents are made, satisfactory answers will be found and the green light will shine. According to one timetable, the OK should appear in about thirty to sixty days after comments are received, any hearings are held and approval is officially documented in the Federal Register.

An indication that all was well in the color case appeared a few weeks before NTSC and others transmitted their opinions to Washington. For, in a letter to Dr. Baker, color committee headman, the FCC's chairman had inquired when the NTSC petition would be sent on. The memo from Washington was sparked by the *RCA* petition, which had noted that the . . . "color standards proposed . . . are technical signal specifications approved February 2, 1953, by outstanding engineers and scientists of the radio and television industry, including members of the petitioners' staffs, through the National Television System Committee."

The Commission's letter declared that . . . "since the NTSC has been engaged in a program of field testing of the NTSC color television specifications, and in light of the fact that the proposed signal specifications now urged . . . are those advanced by your organization, the Commission is desirous of determining when the results of your field testing program will be made available."

The boiling activity in compatible color disturbed some of the Commissioners who had to live through eighteen months of heated color controversy in '49-'50 when the sequential hearings were under way. According to ex-Chairman Paul A. Walker, the earlier sessions were a complete waste of time, because the authorization did not produce color, and black and white television could have had at least a year more behind it, through the earlier approval of the ultra-high channels.

The historic brief filed by the NTSC was an unusually compact document; it contained a report on the signal specs, an opinion on why the NTSC standards meet FCC criteria, and a review of the work that had been assigned to the 10 committees, which comprised the NTSC, and their membership. It also referred to the encyclopaedic appendices that had been filed earlier with the Commission, detailing the reports of each of the committees, the additional comments that were still on their way to Washington, and others that would be filed, as soon as additional data was compiled, for the record.

The proposed standards, said the petition, provide a signal which is capable of operating within a 6-mc. channel and can produce a color picture . . . "which has a high quality of color fidelity, adequate apparent definition, good picture texture (not

newspaper mats and
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m your distributor, or
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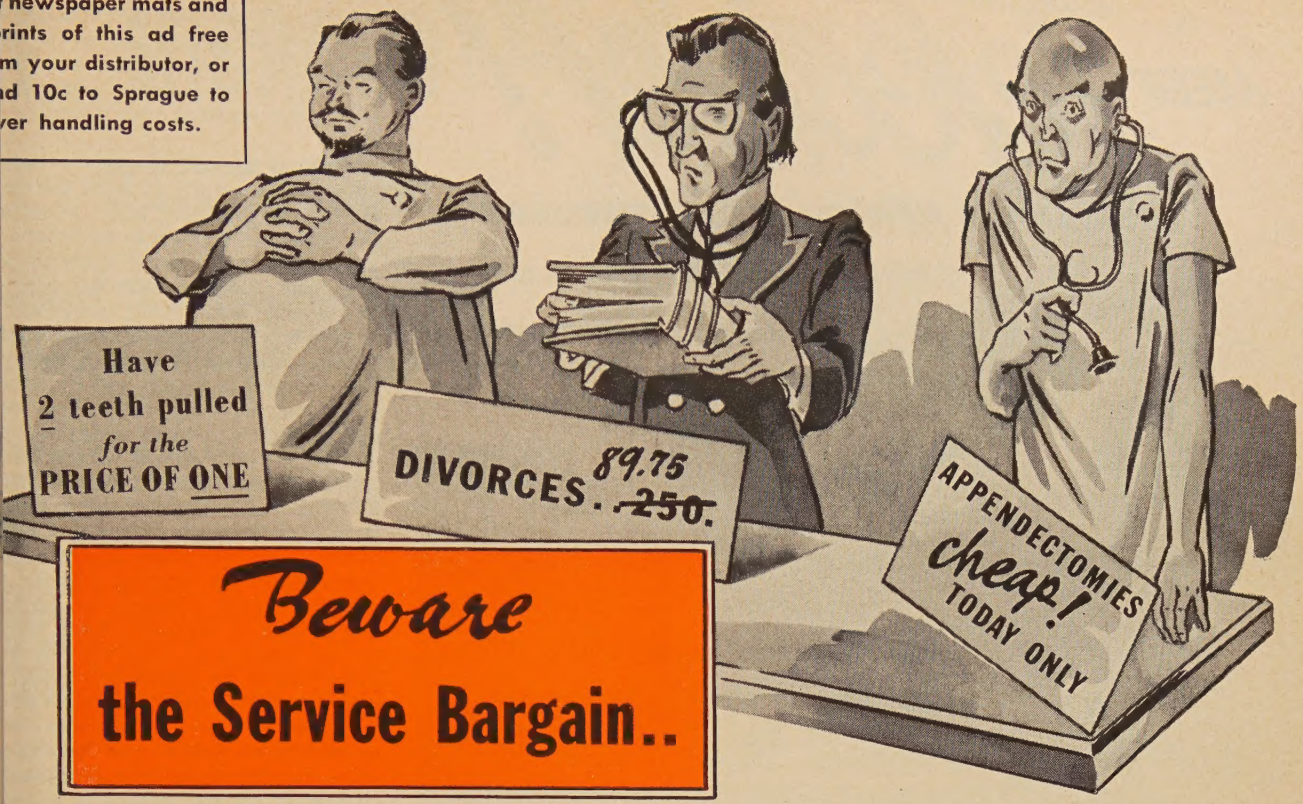
er handling costs.



Beware the Service Bargain..

You'll never see your doctor advertise a special sale on appendectomies . . .
You'll never see your lawyer announce cut-rates for divorce cases . . .
You'll never see your dentist hold a "2-for-1" sale on extractions . . .
AND You'll never see the day when you can take your TV set in for a service "bargain" and be sure you're getting a square deal!

"Bargains" in home electronic service are as scarce as the proverbial hen's teeth! Here's why—

The expert service technician, just like other professional people, must undergo years of study and apprenticeship to learn the fundamentals of his skill. And a minimum investment of from $3000 to $6000 per shop technician is required for the necessary equipment to test today's highly complex sets. Finally, through manufacturer's training courses and his own technical journals, he must keep up with changes that are developing as fast as they ever did in medicine, law, or dentistry. Those best equipped to apply modern scientific methods are almost certain to be most economical for you and definitely more satisfactory in the long run.

Unfortunately, as in any business, there will always be a few fly-by-night operators. But patients, clients, and TV set owners who recognize that you get only what you pay for, will never get gypped. "There just ARE no service bargains"...but there is GOOD SERVICE awaiting you at FAIR PRICES!

Harry Kalber
PRESIDENT

SPRAGUE PRODUCTS COMPANY
North Adams, Mass.

SPRAGUE

WORLD'S LARGEST MANUFACTURER OF ELECTRIC CONDENSERS

marked by such defects as misregis tration, line crawl, jitter, or undul prominent dot or other structure), sufficient brightness so as to permi adequate contrast range, and capabl of being viewed under normal hom conditions without objectionable flick er."

The ten committees, the petition de clared, were charged with the respon sibility of studying and reporting o the subjective aspects of color; colo transcriptions; color system analy sis; color video standards; color syn chronizing standards; receiver com patibility; field testing; broadcast sy tems; coordination; and definition The standards group had quite an a signment, for they had to provide re ommended standards relating to th complete video signal, which include the determination of both colorimetr and electronic specifications. Problem they had to resolve included camer taking and gamma characteristic color-carrier frequency and its pha relation with respect to horizont synchronizing signals; color sequen to be used and whether or not should be of an oscillating type; ban widths of the monochrome and col signals; relative amplitudes of th monochrome signal and the color ca rier; maximum system amplitude d mands at critical colors to enable th determination of picture-to-synchr nizing ratios; and specifications of t radiated signal.

Describing the nature and extent the work done by the field test panel the petition pointed out that o group, who had to test the perfor ance of receivers, required the atte tion of more than 100 engineers, w contributed more than 10,000 man hours. Receivers tested were man by twelve manufacturers, and fi transmitters were used in a total a seventeen field tests.

In a supporting petition, it w noted that the NTSC field tests . "establish that . . . with very f exceptions all existing black a white television receivers can r equal or better black and white p tures from the NTSC signal than fr the present black and white signa In addition, the brief added . . . " interference problems and broadca ing service of existing broadcast stations, with respect to black a white service, will be substantially u changed, in the event that the NT signal is employed."

The brief also emphasized the f that the . . . "NTSC signal will op ate satisfactorily color receivers i will provide all the essential inform tion necessary for the satisfact operation of color receivers throu out substantially the same ser area as black and white receivers."

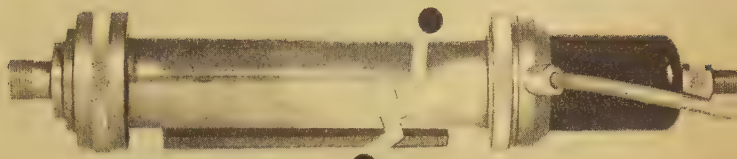
Applauding the proposed standa this petitioner said that the system now evolved . . . "represents soundest method, from a techn point of view, that is known at present state of the art." It seems likely, they added, that . . . "th

(*Continued on page* 165)

F. MICROPOTENTIOMETERS

By **MYRON C. SELBY**
National Bureau of Standards

ipment for production of accurate r.f.
ıals in the 1 to 10^5 microvolt range.



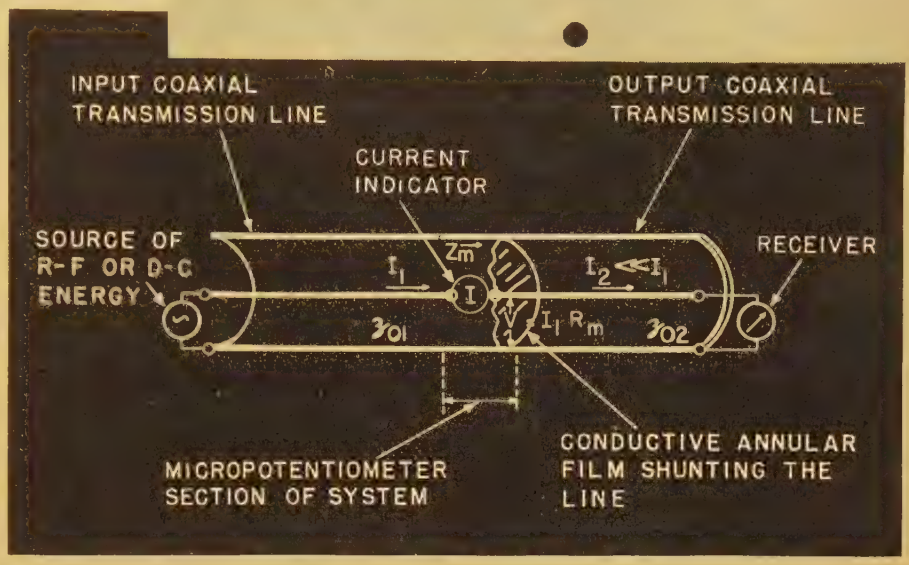


Fig. 1 (top). An over-all view of the coaxial type of micropotentiometer.
Fig. 2 (bottom). Equivalent circuit of system using a micropotentiometer.

NDARD-VOLTAGE generators ve been used for many years to easure sensitivity and selectivity dio receivers, gain and frequency nse of amplifiers; they are also as field intensity reference stand- and for similar purposes where e values down to the order of a volt are required. However, re- of measurements made with in- al generators vary widely, the reement increasing progressively ncreasing frequency and decreas- ltage values. Thus, at 1-μv. levels, tainties of the order of 100% and r are frequently encountered and ments of 5% are rarely found, ularly when different types of ators are involved. Various com- known factors are responsible is difficulty. Among these, prob- he most damaging are the uncer- es in the relative impedances of enerators and of the loads applied m. There seems to be a lack of ence in the condition of the gen- s, leading to rugged, stable, and rather expensive structural es. This lack of confidence also sitates expert, laborious and costly ation procedures for attenuators oltmeters.

a result of this situation, there volved a critical demand for a sim- vice to supply r.f. microvoltages on a principle of operation in- g a high degree of confidence in curacy. Two different types of a device which meet these require- , apparently in all respects, are bed below[1].

ple of Operation

basic principle of operation of icropotentiometer" is extremely e. A known current is fed into wn very low resistance, and the tial drop across the latter gives age which can be precisely calcu- Both the current and resistance n constant at all frequencies of tion. The frequency range ex- up into the u.h.f. region, and no ency corrections need be consid- n this range. The upper frequency limit may be extended, but the top limiting frequency has not as yet been investigated. Resistance is of the order of 1 milliohm for the microvolt range and of the order of 10 to 100 milliohms for the millivolt range. Thus, for all practical purposes, the device is a constant voltage source; normally used loads will not affect its voltage output.

The above properties are obtained as a result of structural features. In the first type (see Fig. 2), the resistance proper consists of a metallic annular film a fraction of a thousandth of an inch thick (for the frequency range indicated). This thickness does not exceed one-half of the skin penetration for the given metal at the highest desired frequency. The resistance of the ring is given by:

$$R = \frac{\delta}{2\pi d} \ln \frac{r_1}{r_2} \text{ ohms} \quad . \quad . \quad . \quad (1)$$

where:
δ = resistivity, ohm cm.
d = thickness, cm.
r_1 and r_2 = large and small radii respectively

Figure 2 shows schematically a system which employs this type of micropotentiometer. The center conductor is actually much larger in diameter than is indicated in the diagram. It can be shown that an annular element of the above structure located in a plane normal to the conductors of a coaxial transmission line is essentially equivalent to a pure shunt resistance over the entire frequency range specified. Thermoelements, thermocouples, thermistors and other types of bolometers may be used as current indicators which are independent of frequency within the given range. The micropotentiometer proper comprises a part of the system shown. A source of r.f. feeds energy to the annular ring through a transmission line and another line supplies the standard voltage to a receiver or any other monitor. This latter line is an integral part of the receiver and is physically connected and disconnected as close as possible to the annular resistor. In practice, the input impedance looking into this line is very high compared with the annular resistance, and therefore has no loading effect upon it. D.C. energy may be substituted for r.f., and either the current or the d.c. resistance of the ring or both may be measured. The d.c. output voltage (across the ring) could be measured or calibrated as a function of the

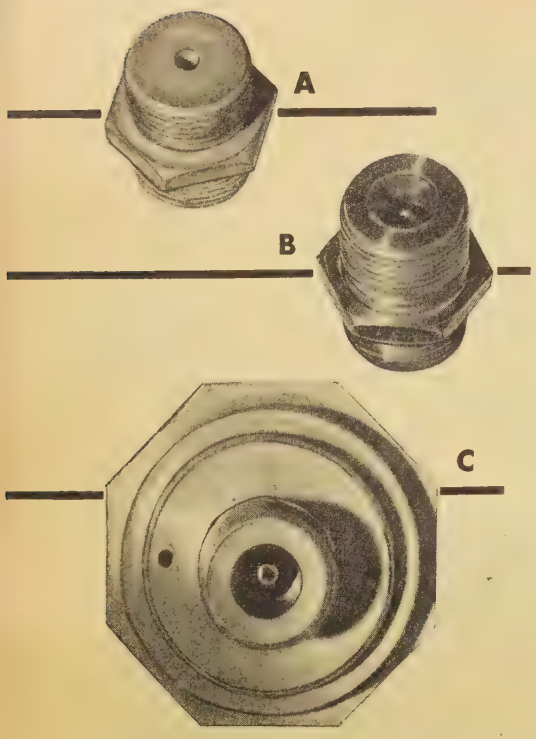
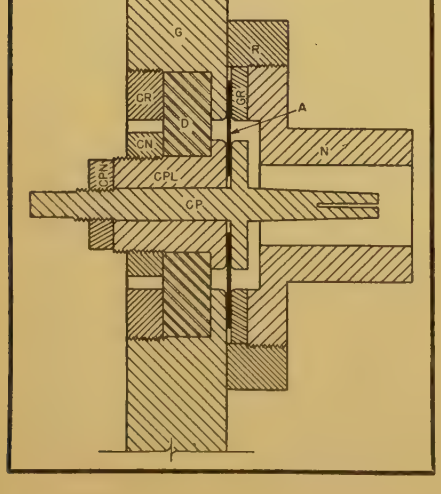


Fig. 3. (A) and (B) are solid resistance elements for a micropotentiometer, and (C) is a clamped type resistance element.

current monitor indications; however, this would be rather difficult to do in the microvolt range at d.c., whereas the resistance can be measured separately.

The voltage range of a single resistive element is limited by the range of the current indicators. For example, thermoelements may be used for currents of 2 to 200 ma. at frequencies to 300 mc. and higher. Thus, a voltage range of 100 to 1 may be available with one resistance element and interchangeable thermoelements. For frequencies up to several megacycles, this range is about 1000 to 1 due to the wider range of thermoelements available. Though there is evidence that the resistance elements will carry currents

Fig. 4. Cross section of clamped type of interchangeable element assembly.



up to 1 ampere, it seems more practical to expand the range further by using several elements of different resistance values rather than by increasing the current. The reasons for this are: (1) the power dissipated in the annular film increases as the square of the current and only as the first power of its resistance, (2) it is increasingly difficult to obtain higher current-carrying monitors which are insensitive to frequency, (3) it is somewhat more difficult to obtain higher currents from conventional sources of r.f., and (4) it may prove more economical to increase the number of resistance elements rather than the number of current monitors.

In general, this micropotentiometer can be made very flexible by having both interchangeable current indicators and interchangeable resistance elements. The resistance range is controllable primarily by the conductivity of the film; it can also be varied within narrow limits by varying the ratio of r_1 to r_2 (Eqt. 1). For lower frequencies the thickness of the film provides another parameter controlling the resistance of the ring, but for a maximum frequency range the thickness should not exceed 50% of the skin penetration, as already pointed out. This places a minimum on the resistance value obtainable with a given metal; higher resistances may be obtained with thinner films of the same metal. Thickness of the film can be decreased to a point at which the film no longer behaves like a solid metal (down to about 50 millimicrons). The complete assembly of a micropotentiometer employing a thermoelement appears in Fig. 7 together with a schematic equivalent of the components.

The "coaxial" type of micropotentiometer, differing only in the basic manner of monitoring the current, is shown schematically in Fig. 5. This unit consists of a length of solid, uniform transmission line having negligible losses; the dielectric may be air or any other conventional solid insulator. The line is terminated by a solid shorting disc having an annular section in accordance with the above requirements. Instead of measuring the current entering the annulus, as is done in the type just discussed, the input voltage into the line section is measured. Under these conditions, to a very good approximation:

$$V_s = I_r Z_0 \sin \beta_0 l \quad . \quad . \quad . \quad . \quad . \quad (2)$$

$$V_r = I_r R_r = V_s \frac{R_r}{Z_0} \csc \beta_0 l$$

$$= V_s K_1 \csc K_2 f \quad . \quad . \quad . \quad . \quad (3)$$

where:

R_r = resistance of annulus, ohms

V_r and V_s = output and input voltages, respectively, volts

I_r = current in the short, amperes

Z_0 = characteristic impedance, ohms

$\beta_0 = 2\pi/\lambda$ = phase constant of line

λ_0 = wavelength of line

l = length of line, meters

f = frequency, cps

Since K_1 and K_2 are both constan for a given air or solid dielectric lin one can plot V_r vs. frequency for V_s 1 volt to facilitate the determination V_r over wide continuous frequency a voltage ranges. This type of microp tentiometer can be conveniently us at check frequencies for which the li is an odd multiple of $\lambda_0/4$, where:

$$V_r = \frac{R_r}{Z_0} V_s \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad ($$

An examination of a cosecant pl will show that a ten to one and larg frequency range is obtainable with single line section. However, the "c axial" micropotentiometer does not ha the continuous wide range and flexib ity of the first type. Two other sho comings are: (1) lower accuracy as result of the limited accuracy of vo meters, and (2) relatively large phy cal dimensions. On the other ha this type offers very attractive fe tures where practicability is of pri consequence. One advantage is t vacuum-tube voltmeters of 10 or 2 accuracy are commonly available; r crovoltages of such accuracy are usua satisfactory for many purposes. Ano er advantage is the elimination of t rather fragile thermoelements a bolometers. A third advantage is the j tential availability of fractions of r crovolts at higher frequencies; cryst rectifier type voltmeters may be e ployed down to 10 mv. and lower i stead of vacuum-tube voltmeters hav a usual bottom limit of 100 mv. A p tograph of a coaxial type micropot tiometer is shown in Fig. 1.

Design Features

The design of practical micropot tiometers depends to a large degree the current-monitoring means, top f quency and voltage range desired. T use of thermoelements requires ter nals for the d.c. output whereas use of bolometers or of direct coup requires either r.f. chokes or block capacitors, or both. This discussion limited to units employing ther elements.

Frequency and voltage ranges gov the design of the resistance elem The resistance element is the com nent of the micropotentiometer sembly which incorporates the an lar resistive film. It will be appar that no separate component is ne sary, that the film can be made integral part of the entire meta shielding enclosure, that the latter r indeed be preferable to reduce the sibility of leakage and radiation, that replaceable units are advis primarily as an economic expedien

rent kinds of replaceable resist-lements are shown in cross sec- Figs. 4 and 6. Figure 6 shows odifications of a solid structure he annular film closely bonded coaxial conductors as well as to parating dielectric. The latter e glass or ceramic, and the elec- are most conveniently made out ss. Kovar-glass sealed terminals e used when properly protected t oxidation. A metallic film is ed over the cylindrical surface e of the end surfaces of the in- g glass or ceramic bushing by burned on or by means of evap- and plating; the assembly is oldered along the cylindrical sur- nto one solid unit, allowing the the end to serve as the annular r. The annulus should be located e as possible to both the current r and to the output plane of the otentiometer, i.e., the resistance t should be as short as possible. listances to the current monitor sult in errors due to the presence rent standing waves. Long dis- to the output plane will result rs due to impedance transforma- y the output line section. For- ly, both errors are potentially at frequencies up to 300 mega- For higher frequencies, the ible unit (Fig. 6A) can be used he annulus at the output plane; mistor as a current indicator will the current distribution error in ase. Figure 6B shows a unit em- g a commercial Kovar-glass terminal. Both units represent l designs suitable for low resist- elements (1 to 100 milliohms) oble metal films.

ther kind of resistance element, Fig. 4), makes use of me- al clamping of threaded mem- This structure has been success- far only for relatively high re- e values (of the order of 1 ohm). useful as a source of accurate es in the millivolt range. Carbon resistance elements may be employed in this case. High resistance elements should be equally easy to obtain with the type of construction shown in Fig. 6; however, the clamped structure is of value where no facilities for film deposition are available. Figures 3A and 3B are photographs of solid resistance elements, and Fig. 3C is a clamped type unit.

Verification of performance of both types of micropotentiometers was obtained in terms of a standardizing-voltage bolometer bridge[2] and precision piston attenuators. Agreements were well within over-all experimental errors, i.e., ±1% to about 50 mc. and ±3% to 300 mc. Measurements at higher frequencies have been conducted so far only on the clamped 1-ohm units and have resulted in agreements of ±5% to 900 mc.

As indicated, the primary objective of a micropotentiometer is to provide accurate voltages for checking standard-voltage generators; and it may also be used directly as a standard-voltage generator. In addition, it is useful in many other applications: (1) voltmeter calibration, (2) calibration of attenuators directly in terms of voltage ratio, (3) determination of current indicator characteristics, (4) determination of output impedances of r.f. sources and circuit networks, (5) calibration of modulation meters—this application being common to all devices employing thermoelements and bolometers with an accurately known correlation of c.w. and modulated power, (6) applications where known voltages in the microvolt range are desired without the usual thermal (Johnson) noise of higher impedance sources present, (7) applications where constant voltage sources are required, e.g., *Q*-measurement circuitry, (8) applications where a single device to cover the entire frequency range from zero to 300 mc. and higher is essential.

Micropotentiometers are particularly suitable for improvising sources of

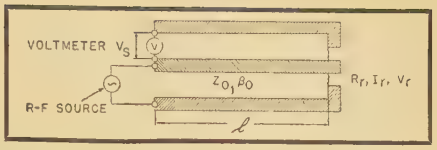


Fig. 5. Schematic representation of coaxial type of micropotentiometer.

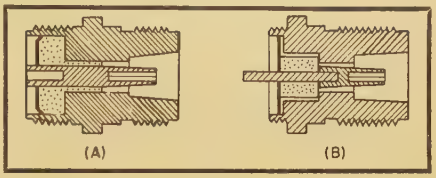


Fig. 6. Cross sections of two types of interchangeable resistance elements.

accurate voltages having any desired source impedances. One needs simply to introduce these desired impedances in the output coaxial connector, and fixed output impedance sources may be standardized and reproduced at will. A standard "dummy antenna" may be used for this purpose with the additional certainty that high internal source impedance commonly encountered in conventional signal generators will not alter the effective impedance of the antenna.

Another application of interest is the standardization of balanced voltages. At lower frequencies, two individual micropotentiometers may be combined and fed from a balanced secondary of a transformer; the amplitude of each half to ground may be readily equalized. At higher frequencies, a single enclosure with two annular elements may be constructed to feed a balanced output twinax termination.

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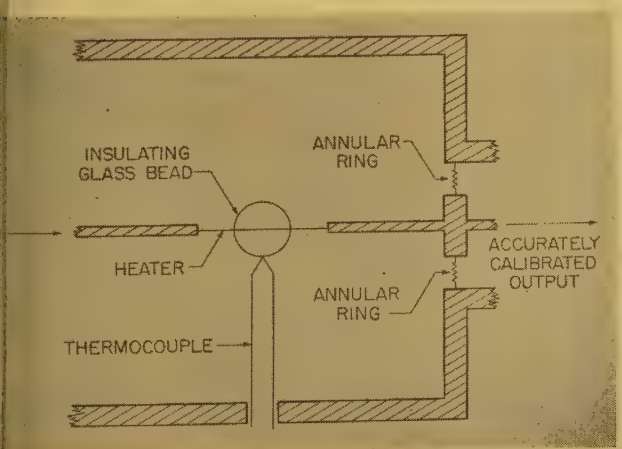
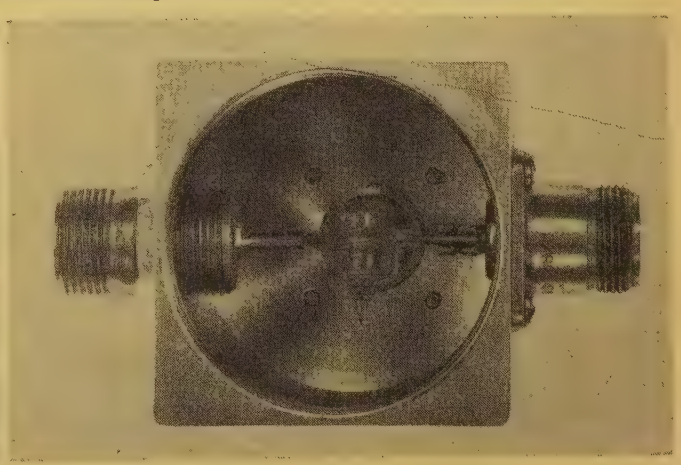
1. *National Bureau of Standards Technical News Bulletin, No. 35, March, 1951, pp. 33-34. Patent applied for in 1951. Selby, M. C., "Accurate Radio-Frequency Microvoltages," Communication and Electronics (AIEE), No. 6, May, 1953, pp. 158-164.*
2. *Selby, M. C., and Behrent, L. F., "A Bolometer Bridge for Standardizing Radio-Frequency Voltmeters." NBS Jrl. of Research, No. 44, 1950, pp. 15, RP 2055.*

Fig. 7. Photograph and schematic equivalent of a micropotentiometer using a thermoelement as a current indicator.





AUTOMATIC GAIN RIDER

By **HERMAN E. KREIGER**
Chief Engineer, Station KHUZ

Low-distortion, wide-range, automatic gain-riding circuit for unattended remote broadcasting service.

PROPER program level control for unattended remote broadcasting (in which there is no operator at the remote point) is a problem common to most broadcast stations. Many studio operators are thoroughly familiar with the grating distortion of an overloaded remote amplifier and the usual inability to reach the announcer at the remote point in order to have the gain reduced. This is especially true of long line broadcasting in which intervening one-way telephone repeaters are used. And these repeaters, like any other amplifiers, will contribute their share of distortion when overdriven by a free-running remote amplifier.

Station KHUZ carries the out-of-town games of local baseball, football and basketball teams by means of long line remotes, with an announcer at the broadcasting point only. It has not been feasible economically for this station to send an operator to each of these sports events, and consequently many of the broadcasts have been of unnecessarily poor quality due to overloading of remote and telephone company equipment.

The difficulty with these remotes has now been overcome quite satisfactorily by the incorporation of an automatic gain-riding circuit within the remote amplifier used for these broadcasts. The circuit is capable of a wide range of attenuation with low distortion and can be readily wired into many existing remote amplifiers.

In this case, the amplifier selected to accompany the circuit was a single-channel *Raytheon* Model RR-10, which readily lends itself to the gain-riding modification with a minimum disturbance of the original wiring and other components. With this amplifier, the cutting of an additional tube socket hole for the (6H6) audio rectifier may be eliminated by substituting a pad not of the plug-in type and using the socket that formerly held the amplifier's 5-db plug-in line isolation pad. Little is lost by using this socket since the attenuation of the pad must be increased to accommodate the necessary increase in output level of the amplifier for t gain-riding modification.

The gain-riding circuit for the RR or a similar amplifier can be wired about two hours. For the RR-10, adapter plate to fit a 1-ma. mete which may be calibrated in db of co pression—will have to be cut to co the larger meter hole remaining wi the amplifier's original vu meter eliminated. In the event that a static present remote equipment is unsa factory for the gain-riding modifi tion, the time and effort needed construct a composite amplifier arou the gain-riding circuit will be spent.

For the amplifier's compression cuit, a 6K7 triode-connected tube chosen to replace the original triode that formed the second stage the RR-10 amplifier. The 6K7 tric connected tube was selected because plate current vs. grid bias charact istic was found to be reasonably ponential and capable of a compress ratio of 20:4.75 db with low distortio

Measurements have borne out fact that compression of the in signal to the amplifier may vary fr 0 to 15 db and effect a distortion in the amplifier's line output of than 1%. This range of attenua exceeds the range necessary to con any normal broadcast.

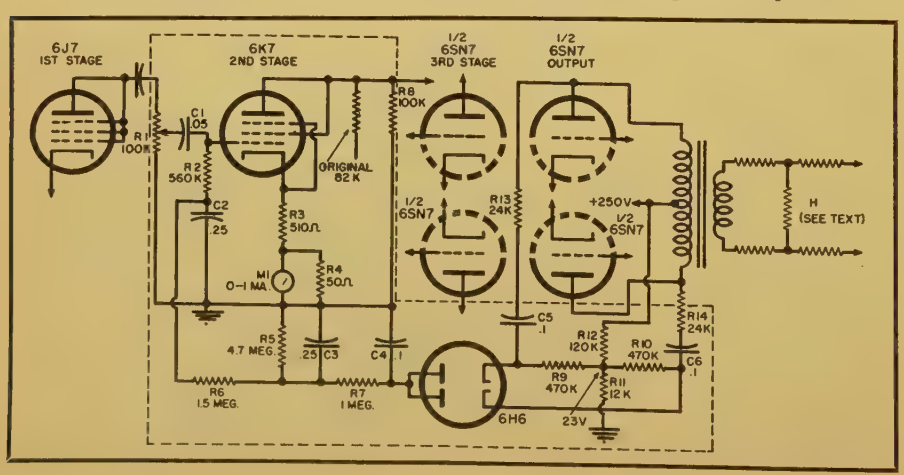
With the 6K7 attenuator tube wo ing single-ended, it is necessary to h filter constants following the a rectifier (6H6) that are comparati slow. Otherwise, unpleasant thu will appear in the output of t amplifier during compression. The n essary delay in the filter has little ef on the gain-riding ability of the am fier. Comparing the attenuator in act practice with an operator, it has b proven that the attack time is s that the attenuator will reduce an o load and restore the gain to nor as effectively as would an opera manually riding gain on the s broadcast.

Release time governed by R_s chosen to prevent a churning effec high compression levels, particularly voice, and to permit a continuous g reduction of 2-3 db for average l program material. This allows s tremely low level program passa of long duration to be raised in amplifier's output by a similar amo

Resistor R_s, between the attenua tube plate and ground, is rather of the ordinary. R_s, in relation to 6K7 attenuator tube, affects the c pression ratio in db by (20:7.25) (20:4.75); i. e., inclusion of R_s per

(*Continued on page 27*)

Circuit modifications for automatic gain control applied to Raytheon amplifier.



*From the point where gain reduction st an input signal increase of 20 db will pro an output signal increase of 4.75 db.

NGLE-SIDEBAND TRANSMISSION

By

ROBERT C. MOSES

Lear, Inc.

A commercial single-sideband exciter which uses the phase-shift principle of operation.

Part 1 of a two-part article discusses SSSC theory and generation by filter and phase-shift systems.

OUGH the basic principles of gle-sideband suppressed-carrier SSC) transmission have been own for more than two decades, cently only very limited applica- s been made of this technique, in point-to-point communications . It is just within the past few hat SSSC has begun to receive tention it merits. Widespread a system which can be shown e several very real advantages nventional double-sideband AM bably been in part curtailed by rtcomings of existing receiving ent; however, recent improve- in the latter open the way to creasing application of the SSSC of transmission.

I of this series draws a direct rison between single-sideband ssed-carrier and double-sideband ansmission systems from both ical and practical standpoints, esents the basic principles gov- generation and amplification of SC signal. Part II will be con- primarily with the design of f the circuits peculiar to SSSC s of transmission, and will in- complete description of a 600- ngle-sideband transmitter of the hift type.

rison of AM and SSSC

nusoidal carrier of amplitude l frequency $\omega/2\pi$, amplitude- ted by a sinusoidal audio com- of single frequency $a/2\pi$, may ressed by:

$$(1 + m \sin at) \sin \omega t \quad . \quad . \quad (1)$$

e is the instantaneous amplitude modulated wave and m is the of modulation. The reference f the carrier has been neglected nplicity. A Fourier-series ex- of Eqt. (1) yields:

$$[\sin \omega t + \frac{m}{2} \sin (\omega + a)t$$

$$\sin (\omega - a)t] \quad . \quad . \quad . \quad . \quad (2)$$

the terms $(\omega + a)$ and $(\omega - a)$ nt the upper and lower sidebands vely. With 100% modulation , the two sideband components oltage or current amplitudes that of the carrier; the power in each sideband under these conditions is therefore one-fourth that in the carrier. In a linear modulation system, the average amplitude of the carrier component, $E_c \sin \omega t$, is constant regardless of the instantaneous value of m; the sideband energy may be thought of as being developed by the modulator. Consequently, for 100% sine-wave modulation, the modulator must generate 50% of the average power represented by the carrier alone.

The sideband components:

$$E_c [(m/2) \sin (\omega + a)t]$$

$$E_c [(m/2) \sin (\omega - a)t]$$

are symmetrically displaced $a/2\pi$ in frequency on either side of the carrier. When both are demodulated simultaneously against the carrier, large with respect to the peak sideband amplitude, the phase relationships are such that the modulation frequency $a/2\pi$ is recovered without distortion. Since the difference frequencies $\omega - (\omega + a)$ and $\omega - (\omega - a)$ are the same except in phase, the intelligence represented by each is identical. It is not necessary, therefore, to transmit both sidebands; insofar as the effect at the demodulator of the receiver is concerned, the recovered audio waveform will be the same except in amplitude whether or not both of the sideband components are present.

Demodulation of a double-sideband AM signal in a linear detector, without excessive distortion, requires that the peak-carrier to peak-sideband amplitude ratio be at least unity; the waveform of the recovered audio components will be substantially altered if the instantaneous amplitude of either sideband appreciably exceeds that of the carrier*. It is not essential, however, that the carrier against which the sidebands are demodulated be the same signal as is generated initially at the transmitter; if a large amplitude local carrier is injected into the receiver, exactly the same conditions as described will prevail at the demodulator, provided that the locally generated carrier maintains precisely the same frequency and phase relative to the two sidebands as does the transmitted carrier. If the amplitude of the locally generated carrier is many times greater than the peak sideband amplitude, and phase and frequency synchronism is maintained, exalted-carrier reception with synchronous detection will result[1].

While in theory it would be possible to eliminate the transmitted carrier completely and resupply it at the receiver, for demodulation of double-sideband signals the practical difficulty of maintaining exact phase and frequency relationship between the transmitted sidebands and the locally generated carrier makes it necessary to transmit at least a "pilot" carrier, somewhat reduced in amplitude, for control of the

**If the two signals have the same amplitude, the demodulated output will contain 20% second harmonic.*

The "Sideband Slicer," a receiver adapter which utilizes the phase-shift principle to provide selectable single-sideband reception of SSB, AM, PM and c.w. signals.

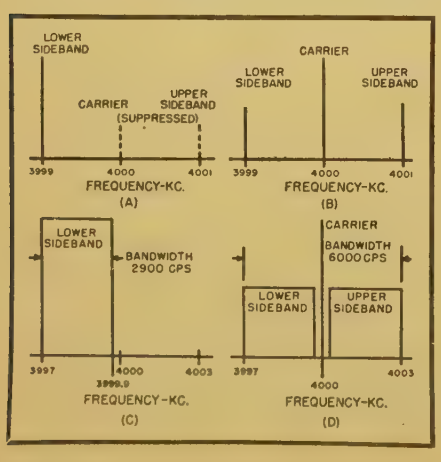
receiver local oscillator. If only one of the sidebands normally produced in the modulation process is transmitted, however, exact phase and frequency synchronism between the locally generated and transmitted carriers is no longer necessary. The transmitted carrier can then be completely suppressed and resupplied at the receiver without too much difficulty. Experience has shown that the local carrier may be as much as 30 cycles removed from its correct frequency before the intelligibility of the received single-sideband suppressed-carrier signal is appreciably impaired.

A line spectrum of such an SSSC signal is shown in Fig. 1A for a 4000-kc. carrier and a 1000-cycle modulating signal, with the carrier and upper sideband completely suppressed. The corresponding double-sideband AM signal appears in Fig. 1B for comparison. The lower sideband of the SSSC signal is represented by:

$$e_s = kmE_c[\sin(\omega - a)t] \quad . \quad . \quad . \quad . \quad (3)$$

neglecting phase, where k is a constant less than unity determined by the type of modulation employed.

Fig. 1. (A) Line spectrum of SSSC signal. (B) Line spectrum of double-sideband AM signal. (C) SSSC channel with 100-3000 cycle modulation. (D) Double-sideband AM channel with 100-3000 cycle modulation.



For a fixed-frequency modulating signal $a/2\pi$, the SSSC signal is a pure r.f. component of frequency $(\omega - a)/2\pi$ and amplitude kmE_c. The modulation envelope, characteristic of the corresponding AM signal, is not present. If the modulating signal consists of a band of audio frequencies $\Delta a/2\pi$, ranging from say 100 to 3000 cps, the corresponding r.f. components are $(\omega - \Delta a)/2\pi$, having instantaneous amplitudes exactly proportional to the instantaneous amplitudes of the individual modulating components. These individual components may be thought of as having "moved upstairs," while still retaining their original frequency relationships to each other, as shown in Fig. 1C. The spectrum of the corresponding double-sideband AM signal is shown in Fig. 1D.

The effective communication channel-width occupied by the SSSC signal extends from 3997 to 3999.9 kc., exactly the bandwidth Δa of the original modulation components. On the other hand, the channel-width of the double-sideband AM signal is slightly over twice the bandwidth of the modulating signal. The single-sideband signal, therefore, is far more conservative of spectrum space, since it takes up only the bandwidth required for transmission of those sideband components necessary to intelligence. By the same token, the energy content represented by the intelligence-carrying sideband components is concentrated into an r.f. band having slightly less than one-half the width of that required by the corresponding AM signal; hence, for an equivalent sideband power, the SSSC signal is at least 3 db more effective. The 3-db gain is greatly enhanced by the attendant reduction in necessary receiver bandwidth and resultant improvement in over-all signal-to-noise ratio.

A further and very real improvement in over-all efficiency as compared with double-sideband plus carrier transmission becomes apparent when it is realized that the power represented by the carrier—which itself is equivalent to twice the total sideband power and does not contribute intelligence—is now placed in one sideband. For a given transmitter power capability, elimination of the carrier results in a theoretical gain of 4.8 db; practically, this is nearer 6 to 7 db because the peak sideband power—when integrated over many audio cycles—seldom approaches 50% of carrier conditions with a voice modulation. The net improvement in communication effectiveness of SSSC over double-sideband AM, all factors considered, may be as much as 9 to 10 db. Using a given tube or pair of tubes in the final r.f. amplifier, this means that the effective power output with SSSC transmission will approach 8 to 10 times that attainable with conventional AM.

Generation of SSSC Signal

Two methods of developing a single sideband suppressed-carrier signal, known respectively as the filter system and the phase-shift system, are in general use. Although basically different, each is capable of good over-all efficiency and linearity, and both provide the 9-10 db effective gain over an AM transmitter of equivalent power capabilities. By the same token, each system has its own advantages and shortcomings when placed on a comparative basis.

Filter System

The filter system depends upon generation at low level of a double-sideband AM signal with carrier suppressed and upon subsequent filtering to remove the undesired sideband component. The resulting SSSC signal, which is of necessity at a relatively low radio frequency, is then remodulated upon a high frequency carrier, filtered again to remove this carrier and the undesired products of the second modulation, and amplified at the final operating frequency in one or more linear r.f. amplifiers. A block diagram of a typical filter system, designed for operation at 4.0 mc., is shown in Fig. 3.

A low-frequency double-sideband signal having components:

$$kmE_c \sin(\omega_1 - a)t$$
$$kmE_c \sin(\omega_1 + a)t$$

—the lower and upper sidebands—is generated in a balanced modulator at a level of a few volts. Phase relationships herein are such that the circuit is balanced for any carrier component $E_c \sin \omega_1 t$; hence the latter is cancelled and the sidebands only appear at the modulator output. The modulator output impedance is designed to be very small for the modulating frequency a, and relatively large for the sideband components. Two sidebands, of equal amplitude, are passed on to the following filter network.

It is impractical to design a sideband filter having the required attenuation characteristics for operation at radio frequencies above about 500 kc.; therefore at this low a frequency, the filter must take the form of a complex lattice network or equivalent utilizing very large Q reactances if the rejection of

ed sideband is to exceed 20 db Generation of the single side- herefore, must be accomplished v at a relatively low r.f., and iently heterodyned to the final ng frequency. In a properly de- and constructed 460-kc. lattice using quartz crystal reactive ts, the attenuation of the un- sideband may exceed 35 db over eful range. Figure 2 shows the ission characteristics vs. fre- of a typical crystal-lattice filter d for transmission of the lower id. Several variations of the lat- nfiguration are in use.

use any form of frequency ier would destroy the frequency nship between the individual id components, the single-side- uppressed-carrier signal at the of the sideband filter is hetero- to the final output frequency in r or frequency converter similar used in receiver applications. ed operation of the mixer stage necessary unless the frequencies original sideband $(\omega_1 - a)$ and erodyning oscillator ω_2 are quite ogether, as in the conversion of kc. sideband to 14 mc.; in such rejection of the oscillator signal mple bandpass filter may be dif- Balanced mixers are also fre- used in cases where appreciable power is required for the grids following stage. The upper and ideband components $\omega_2 + (\omega_1 - a)$ $- (\omega_1 - a)$ of the remodulation are separated in a second filter may be a relatively simple , and the final SSSC signal at erating frequency is built up to ired power level in one or more r.f. amplifiers.

filter method of generating an signal is straightforward and noncritical (except possibly for design and adjustment of the d filter). Consequently, it is ly easy to adjust for optimum ed sideband suppression, and t up, will retain its adjustment g periods of time. On the other is the system requires at least terodyning process in order to at the final operating frequency, need more stages than a phase- ystem of equivalent power cap- s. Also, the filter system general- lves some special components, uartz crystals or high-Q re- in the sideband filter, and there- ay prove to be somewhat more Selection of either sideband is usually very difficult with a ilter.

Shift System

phase-shift or phasing method of developing an SSSC signal is based upon the phase relations between the carrier and its sidebands in an amplitude-modulated wave.

Referring to the block diagram of Fig. 5, a carrier E_c—which can be at the operating frequency—is generated at low level in a stable oscillator and split into two equal components. One of these, $E_c \angle 0°$, is applied directly to balanced modulator A. The other carrier component, $E_c \angle 90°$, is rotated in phase by 90° in a suitable r.f. phase-shift network and applied to balanced modulator B. Audio signal E_a is also split into two equal components having a 90° phase relationship, and quadrature voltages $E_a \angle 0°$ and $E_a \angle 90°$ (or 270°) are applied to the appropriate balanced modulator. The individual carriers are cancelled in the balanced modulators, whereas the sideband outputs of the latter are combined in an adding network. The resulting SSSC signal is then amplified to the desired power level in one or more r.f. linear amplifiers. Adjustments are provided within the system to permit equalizing the individual carrier and modulating voltages and effective modulation factors; further adjustments achieve the necessary 90° carrier and audio phase relationships at each modulator.

The mechanics whereby a single-sideband output is produced in the phase-shift system can be mathematically analyzed as follows:

If E_A and E_B are the output voltages of modulators A and B respectively, E_c is the carrier voltage applied in quadrature to both, $\omega/2\pi$ and $a/2\pi$ are the carrier and modulating frequencies, and m_1 and m_2 the modulation factors, then:

$$E_A = km_1E_c \ (\sin \omega t \sin at)$$
$$E_B = km_2E_c \ (\cos \omega t \cos at)$$

Adding these gives:

$$E_A + E_B = kE_c \ [m_1(\sin \omega t \sin at) + m_2(\cos \omega t \cos at)]$$
$$= kE_c \left[\frac{m_1}{2} \cos (\omega - a)t - \frac{m_1}{2} \cos (\omega + a)t + \frac{m_2}{2} \cos (\omega - a)t + \frac{m_2}{2} \cos (\omega + a)t \right] \quad . \quad . \quad . \quad . \quad . \quad (4A)$$

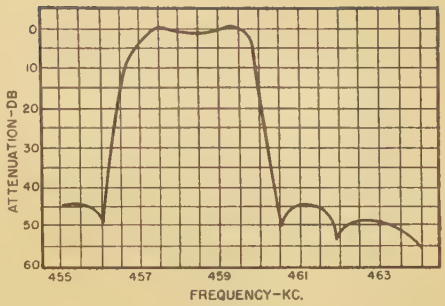


Fig. 2. Typical sideband filter transmission characteristics.

If $m_1 = m_2 = m$, Eqt. (4A) becomes simply:

$$E_A + E_B = kmE_c \cos (\omega - a)t. \quad . \quad (4B)$$

which contains only the lower sideband. Shifting the phase of E_B through 180° gives:

$$E_A - E_B = -kmE_c \cos (\omega + a)t \quad . \quad (4C)$$

—the upper sideband.

Equation (4A) illustrates the necessity of maintaining exact 90° phase relationships throughout the system as well as equal values of m_1 and m_2; departures from quadrature phase relations in either carrier or audio components, or inequality of the respective modulation factors, will lead to incomplete cancellation of the undesired sideband. It can be shown that the undesired sideband attenuation for a small departure ϕ from 90° audio or r.f. phase relationship is very nearly:

$$\text{Atten. (db)} \cong 20 \log_{10} \frac{1}{\sin \phi} \quad . \quad . \quad (5)$$

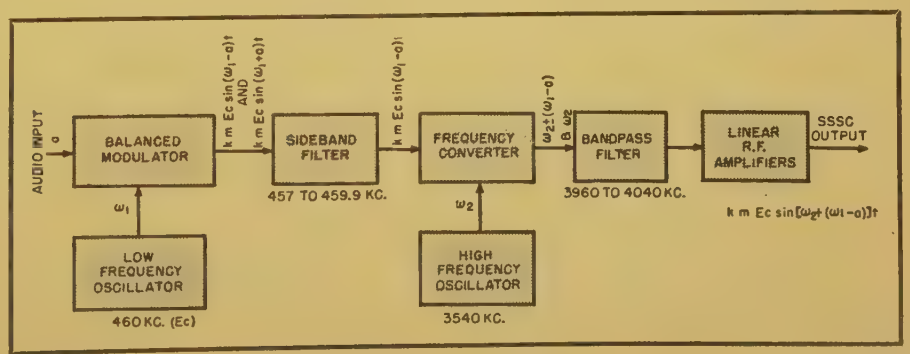
where $\phi \leqq 10°$, and the amplitudes of the sine and cosine components are equal $(m_1 = m_2)$. The effect of amplitude differences upon sideband rejection is given in Eqt. (6), where correct phase relationships are maintained:

$$\text{Atten. (db)} = 20 \log_{10} \frac{m_1}{m_1 - m_2} \quad . \quad (6)$$

where m_1 and m_2 are the effective modulation factors, and $m_1 \geqq m_2$. The amplitude ratio of desired to undesired sideband output as a function of phase and amplitude disparities is plotted in Fig. 4.

The undesired sideband attenuation

Fig. 3. Block diagram of a typical filter system for SSSC transmission.



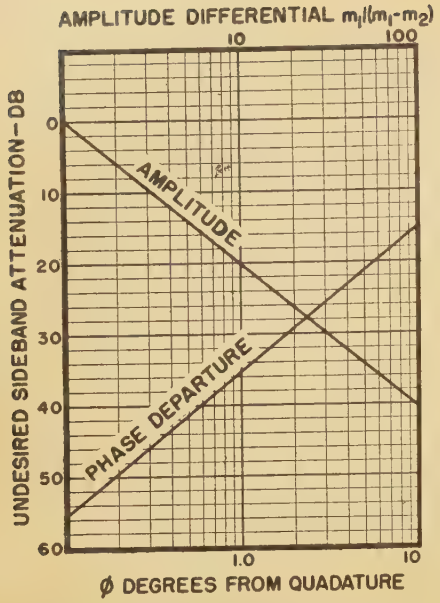


Fig. 4. Undesired sideband attenuation vs. amplitude and phase-angle departure in degrees from quadrature.

obtained in a properly adjusted phase-shift system is a direct function of the extent to which the audio phase-shifting network maintains the required 90° phase relation and output voltage equality over the frequency range of interest. While infinite rejection of the undesired sideband is theoretically possible, the practical difficulty of holding exact quadrature phase relationship and equal amplitudes between the audio components usually restricts the average attenuation to the order of 35-40 db over the range from 100 to 3000 cps. Audio phase-shift networks capable of providing this order of performance have been designed [2, 3] and usually consist of appropriate *RC* lattice networks or cascaded 90° lead-lag networks staggered at specific frequencies within the operating range.

With proper design and adjustment, the phase-shift method of SSSC generation is capable of providing a degree of suppression of the undesired sideband at least as good as that of an equivalent filter system. It is apt to be somewhat less complicated than the latter, equipmentwise, in that development of the single sideband may take place directly at the operating frequency. For fixed-frequency operation, intermediate heterodyning processes are not necessary; hence, fewer stages will be needed. At the same time, no special components are required; the design will in most cases prove less costly than a filter system of the same power capability. The phase-shift system also lends itself without additional complication to operation on either sideband at will, as well as to generation of double-sideband AM and phase modulation with carrier reinserted. On the other hand, adjustment of the phase-shift system for optimum performance is apt to be somewhat more difficult and will usually require additional test equipment. By the same token, the phase-shift system is inherently less stable in adjustment over extended periods of time, and will generally demand more frequent attention if the maximum capabilities of the system are to be maintained.

Amplification of SSSC Signals

As the previous analyses have shown, an SSSC signal generated by either the filter or phase-shift method consists of a single r.f. component $kmE_c \sin(\omega \pm a)t$. The amplitude of this component, insofar as the modulating signal is concerned, varies directly and linearly with m; consequently, any amplifiers required to handle the SSSC signal must display a linear relationship between grid exciting voltage and a.c. load current. Departure from linearity in an r.f. amplifier for SSSC applications will result in generation of spurious distortion products and create sideband components on the side that was suppressed in the exciter.

Linear amplifiers for SSSC have direct counterparts in amplifiers designed for a.f. applications. Tubes designed for audio work will operate in linear amplifiers at substantially the same power output and efficiency provided of course that the tubes will function properly at r.f. In common with audio system designs, class A, AB_1 stages are useful in the 2-15 watt power output range; for improved efficiency, class AB_2 and class B amplifiers find application at higher power levels. Because an r.f. linear amplifier is a single-frequency affair, tuned input and output circuits having moderately high *Q*'s are employed; in contrast to the audio case, therefore, push-pull operation of a class B linear amplifier is not essential.

As the factors governing design and adjustment of an r.f. linear amplifier are equivalent in many respects to those of conventional audio practice, detailed treatment is not necessary here. Calculations of peak power output, efficiency, optimum load impedance, grid-driving signal levels, and tube operating conditions are carried out according to the usual procedure.

The maximum-signal efficiency to be expected in a properly adjusted class B linear amplifier is of the order of 60-70%, with an effective power gain of between 12 and 15 db. In class A and class AB_2 systems, the efficiency is somewhat lower, 35-50% being typical. On the other hand, the power gain becomes much larger, reaching values as high as 40 db for amplifiers operated without grid current. Since linearity of the system is generally better as the operation tends more toward straight class A, this class of amplifier is frequently used in low-level stages where power efficiency is not a problem.

With either type of SSSC generation the audio requirements are completely independent of the final r.f. power level of the transmitter; an effective audio power of less than two watts is sufficient to drive virtually any low-level balanced modulator. Consequently, the SSSC transmitter represents a considerable saving in the audio end of the system over an equivalent AM transmitter. This is particularly true at higher r.f. power levels, where the audio requirements of the latter demand the use of large tubes and components.

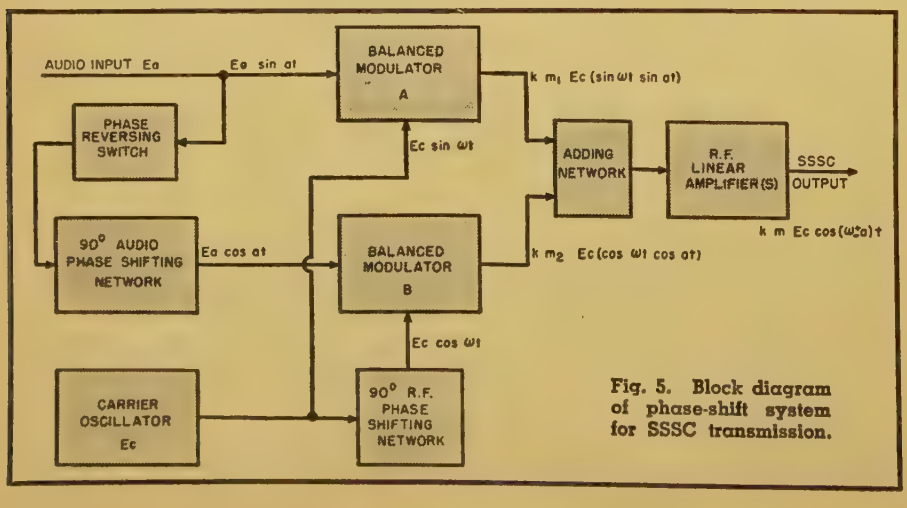


Fig. 5. Block diagram of phase-shift system for SSSC transmission.

Operating Characteristics

Apart from the improvement in communication effectiveness of single-sideband suppressed-carrier over double-sideband AM, SSSC features certain operating advantages with regard to cochannel and adjacent-channel interference, fading, and effects of noise and atmospheric disturbances. These advantages become most apparent when the SSSC signal is received on se-

(*Continued on page* 29)

[RTICALLY POLARIZED
ICROWAVE ANTENNA

By

R. K. THOMAS and M. E. RINGENBACH

Bendix Radio Div., Bendix Aviation Corporation

Design details and performance of a microwave antenna giving a specific radiation pattern.

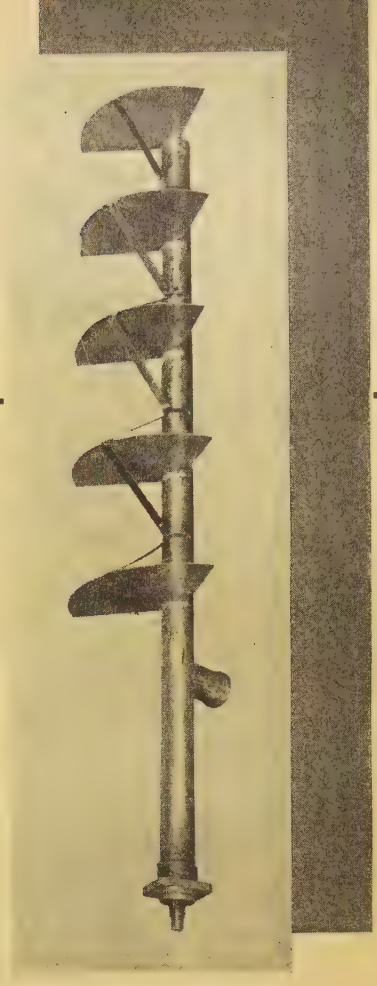


Fig. 1. The coaxial vertically stacked array.

f antenna to be described below
v developed to meet specifications
h required a fan-shaped beam
y in the vertical dimension. Polar-
d was to be vertical, and physical
nions were such that the weight
ze of the antenna were to be kept
all as possible. Consideration of
st item led to the choice of rigid
l line as a structural basis, rather
the bulkier and heavier wave
The desired frequency band was
that a stub-supported line could
ected as being satisfactory elec-
y and mechanically, as well as
obtainable.

simplest form of radiating ele-
which could be incorporated in
line was deemed to be a series
ut part of the way around the
nference of the line. Since no in-
probing of the line was contem-
, there would be no mechanism for
reversal, and the elements would,
ce, be situated at one wavelength
g along the array. It thus became
necessary to provide means for holding the phase front reasonably flat in order to avoid the existence of undesirably large side lobes. This was readily accomplished by tying the slot edges together at their centers with V-shaped metal struts, as indicated in Fig. 2, which is a sketch of the rudimentary antenna structure. The structure then becomes equivalent to a vertical slice of an array of small horns, although the aperture length was made 4λ in order to secure the required degree of directivity in the vertical plane. Figure 3 shows the corresponding E-plane pattern for such a configuration; the resulting maximum side lobe of 12-db intensity below the main beam, which is only slightly greater than that which would be obtained from a uniformly illuminated array, was satisfactory for the required application. No beam tilt or pattern degradation was observed throughout the required frequency band.

In order to control the horizontal beamwidth, the struts were connected to metal sectors as shown in Fig. 2. These sectors permit the electric field to spread around in azimuth, leading to the H-plane pattern shown in Fig. 3. (If the slots are joined to the sectors by conical segments instead of thin struts, the azimuthal beamwidths obtainable will be almost directly proportional to the sector angle over a fairly wide range.) Cross-polarization properties are satisfactory, the undesired polarization being at least 20 db down in all cases measured.

Knowing the number of elements which would be required to give the desired vertical directivity—four in this case—it next became necessary to investigate the impedance properties of an individual element, as well as the mutual impedance between such elements, in order to match the array to the feed line satisfactorily. The technique involved in making such measurements was to terminate the antenna in a matched load in order to eliminate any unknowns introduced by short-circuited sections of line, and then subtract this series load from the resulting impedance measurement to arrive at the correct value for the antenna itself. This investigation showed that the mutual impedance between adjacent elements is quite low and can be neglected when the element spacing is 1λ.

(*Continued on page* 27)

g. 2. (A) Side view and (B) top
ow showing antenna construction.

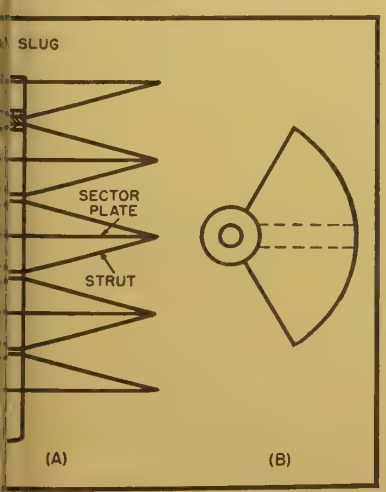
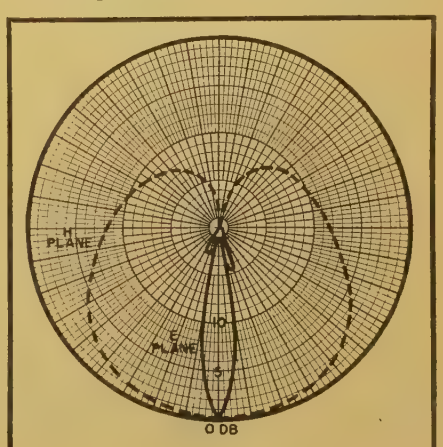


Fig. 3. E-plane and H-plane pattern. Half-power beamwidths are 13° for the E plane and 112° for the H plane.



DEVELOPMENTS AT NBS

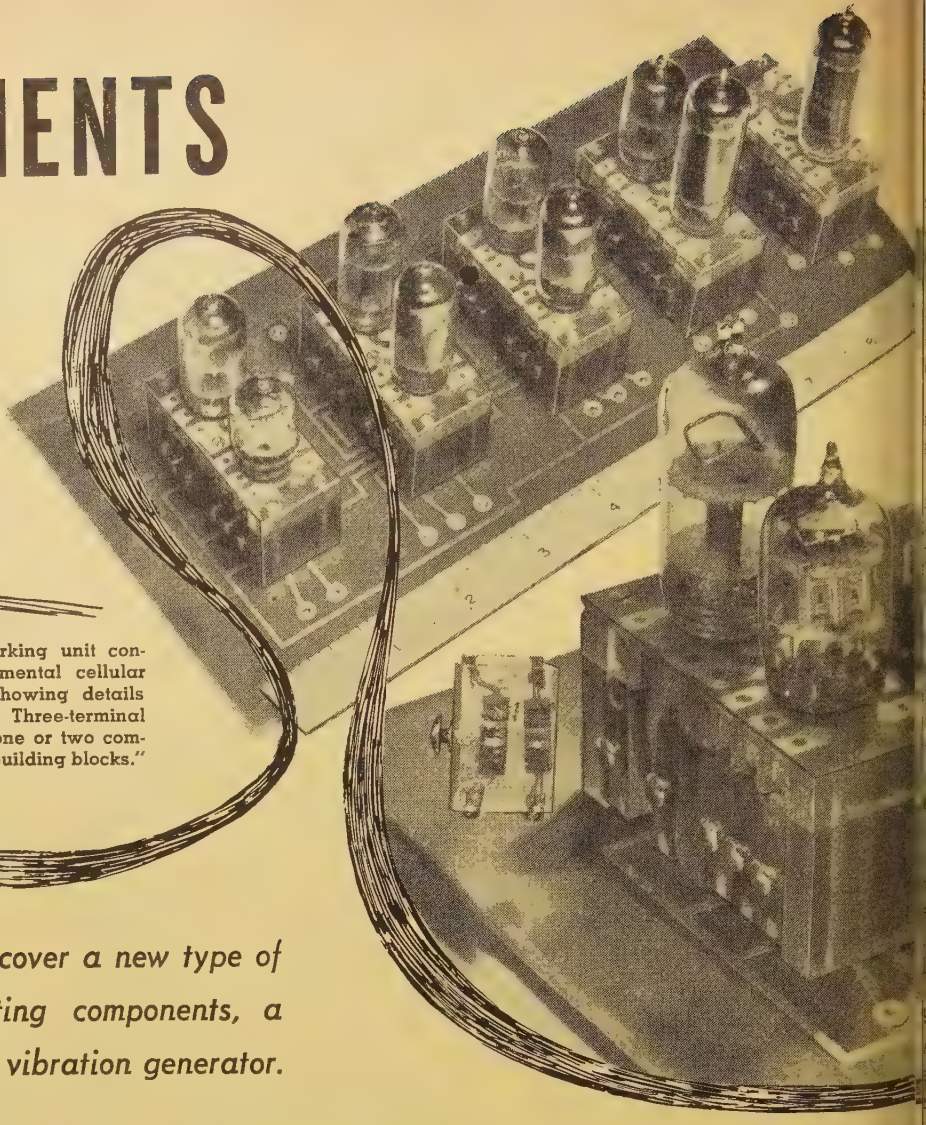


Fig. 1. (Top) A nine-tube working unit constructed at NBS using experimental cellular technique. (Bottom) Close-up showing details of the cellular construction. Three-terminal molded cells, each containing one or two components, fit into two-tube "building blocks."

Recent announcements cover a new type of construction for mounting components, a micromanometer, and a vibration generator.

INTEREST IN electronics is high at the National Bureau of Standards, judging from the continual flow of information released by this organization. The following report describes three developments on which information has been made available.

"Cellular" Construction

Printed electronic circuits in which conducting patterns etched on plastics take the place of conventional wiring have come into fairly wide use, and several solutions have been offered to the problem of connecting components and tubes to the printed sheets. However, the diversity of these solutions and their inability to gain widespread acceptance would seem to indicate that the optimum answer has not yet been found.

In a novel approach to the problem currently being investigated by NBS, small three-contact molded blocks or cells—each containing one or two circuit elements (resistors, capacitors, or inductors)—are pressed against the etched circuit pattern by means of springs which are extensions of the tube socket contacts. No soldering is needed. This experimental technique is one of a number being studied at the Bureau in a program for improving construction and maintenance of electronic equipment which is sponsored by the Navy Bureau of Aeronautics. Proposed by Dr. P. J. Selgin of the NBS Engineering Electronics Laboratory, the cellular assembly method has several interesting features that could prove advantageous. See Fig. 1.

Individual molded cells are about ⅞" high by ½" wide by ¼" thick. Each has three contacts, one on the top and two on the bottom. The cells are grouped together in "building blocks," each of which comprises two tubes and twelve cells held in a compact bundle by means of a suitable frame. The top surface of each block consists of a spring assembly containing the tube sockets and the necessary spring contacts. When the block is fastened to the printed base plate by means of screws, springs in the spring assembly apply substantial pressure to the top terminal of each cell and hold the two bottom terminals firmly in contact with the printed circuit pattern. Positive and noise-free electrical connection is further assured by the application of a thin film of grease to the cell contacts.

The two-tube block is considered an optimum-sized subassembly in the NBS system. Any number of the blocks ca be mounted on a suitably printed bas plate of sufficient area. Potentially i expensive, they are compact (abou 2¼" x 1" x 1⅜", exclusive of tubes and are easy to store and to handl They are also extremely rugged; s long as a block is secured to the ba plate, none of the cells can vibrate e shake loose.

One noteworthy feature of this tec nique is the quick replaceability of bo blocks and cells without the use plugs or connectors. If conventiona "plug-in" assemblies were made small as the blocks, the plugs would ad substantially to both size and cos Elimination of both soldering labor an multiple connectors results in a doub saving.

In case of trouble, an entire blo can be easily removed for repair or r placement, simply by loosening t screws that hold it to the base plat Either on the spot or after return the factory or service laboratory, d fective blocks can be quickly repair by replacing faulty cells. Each cell identified by suitable markings.

An important aspect of the use three-terminal cells is the fact th positive pressure can be maintained

oints, and only three points, by
le spring. Fortunately, in the
najority of electronic circuits, no
nan two circuit elements need be
ted electrically to a single tube
de. A three-terminal cell, there-
lesides being easy to hold under
pring pressure, will in general
e enough electrical contacts for
ments associated with any tube
xceptional cases can be handled
ans of a spare cell which is not
ted to the tube pins. It is also
e to provide three-terminal cells
ble or triple the standard thick-
o accommodate occasional over-
lements.

practical possibilities of this
f construction would appear to
firmed by an experimental nine-
ellular circuit which has already
onstructed at the Bureau. For
ience, a casting resin was used
om temperature to form the
number of cells needed in the
, although this is not the best
al for the purpose. For quantity
tion, cells could be molded in
ic by the process now in wide use
aking resistors and capacitors;
mponents would be spotwelded to
other and to the terminal tabs
molding.

Resolution Micromanometer

ighly sensitive micromanometer,
ed to measure differential pres-
as low as 0.03 micron of mercury
03 mm. Hg or 1.6 x 10^{-5} inches of
with resolutions of the order of
micron Hg, has recently been de-
d by T. A. Perls, W. H. Kaechele,
S. Goalwin. This development
result of a research program con-
by the Bureau's Office of Basic
mentation and sponsored jointly
Office of Naval Research, the Air
rch and Development Command,
and the Atomic Energy Commission. The NBS micromanometer utilizes a thin diaphragm combined with a capacitance-type pickup and a resonant-bridge carrier system to detect pressure differentials 100 to 1000 times smaller than those previously detectable. Besides measuring static differentials, it can sense pressures that vary at rates up to 20 cps with an accuracy of better than 2%. See Fig. 2.

This device consists of a 3"-diameter corrugated diaphragm made of brass sheet 0.001" thick and mounted in a shallow cylindrical cavity. The diaphragm is placed so as to divide the cavity into two pressure-tight chambers. An insulated electrode passes through the top of the cylinder to become one side of a variable capacitor while the flexible diaphragm forms the other side of the capacitor, which then has a nominal capacitance of about 20 $\mu\mu$fd. Changes in either temperature or pressure within one of the cavities cause the diaphragm to flex and move. This motion varies the electrode-diaphragm spacing and, consequently, the capacitance of the system is changed by a small amount. Over the mechanical operating range used, the displacement of the diaphragm varies directly as the pressure differential, and the changes in capacitance also vary linearly with the displacement of the diaphragm. The electronic portion of the micromanometer has sufficient range of sensitivity to respond, with an accuracy of 2%, to full-scale changes between 0.005 and 0.2 $\mu\mu$fd. above and below the 20-$\mu\mu$fd. capacitance of the system.

The electrode-diaphragm-cavity section of the micromanometer forms the fourth arm of a resonant capacitance bridge composed of three other capacitors, each of which has a low multimegohm resistance in parallel with it. Parallel resistances tend to make negligible any changes in leakage resistance of the capacitors. Driving power for the resonant capacitance bridge is derived from a 500-kc. crystal oscillator; a frequency response flat within $\pm$ 1.5% from 0 to 50 kc. is one of the useful characteristics of the carrier circuit. A small difference in pressure between the two cavities in the micromanometer, which causes a deflection of the diaphragm and thus a change in the capacitance of the system, upsets the balance of the resonant capacitance bridge. The 500-kc. output from the bridge varies in amplitude according to the magnitude of the pressure change and in phase (0 or 180°) depending on the direction of the deflection. The signal-modulated carrier from the bridge is amplified and then mixed with the unmodulated carrier from the 500-kc. driving oscillator in a special mixer, phase discriminator, and dual demodulator stage. In this stage, the two signals add or subtract according to the direction of the original diaphragm displacement.

The output of the mixer is a replica of the capacitance change in the resonant capacitance bridge, and, consequently, a measure of the differential pressure. The unwanted 500-kc. and 1000-kc. harmonics in the output are filtered, and the resulting low frequency or d. c. potential is applied through a d. c. amplifier directly to the plates of a cathode-ray oscilloscope or to any other suitable indicating or recording device. Response of the system—both mechanical and electrical—over the pressure range used is sufficiently linear to require the calibration of pressure differential vs. voltage output only at "zero" and at one other point within the operating range, usually chosen near "full scale." Resulting readings can be made with an accuracy of 2%.

(*Continued on page* 26)

Fig. 2. Cut-away drawing of pressure probe for the NBS thin-diaphragm capacitance-type micromanometer.

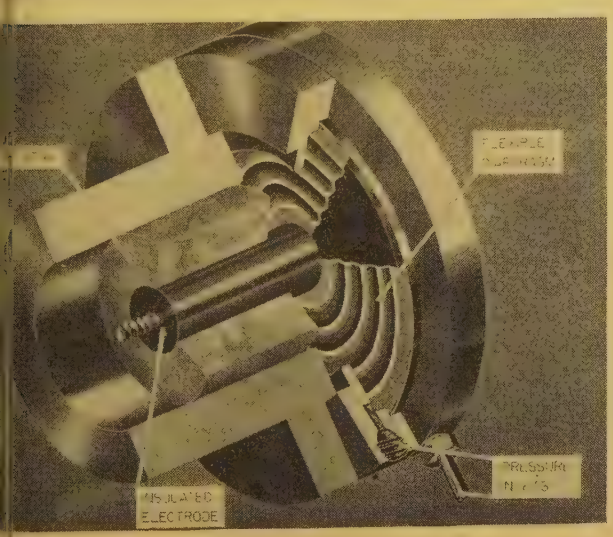


Fig. 3. Inserting an experimental subminiature tube into the recently developed wide-range tube vibrator.

PORTABLE REMOTE BROADCAST AMPLIFIER

By

RAY GILLIAM, Chief Engineer, WKDK

Newberry Broadcasting Co., Inc.

Versatile self-powered amplifier with line-level output is useful for remote sports broadcasts.

Front view of the completed amplifier with plugged-in microphone.

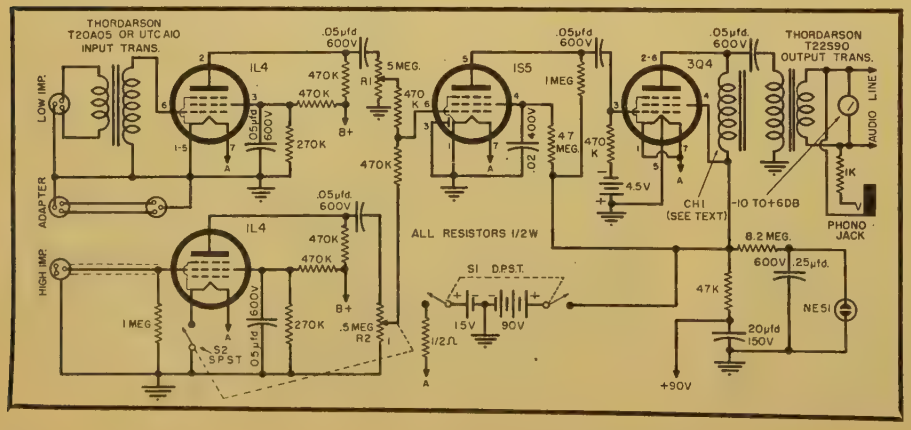
REMOTE broadcasting of sports events always presents a problem in high school and small college stadiums. In most cases, the telephone company will provide lines as specified by the engineer. That leaves the radio man at times with the difficult problem of connecting the amplifier to the a.c. line. Climbing poles and running a.c. extension lines a hundred feet or more, only to have someone turn off the receptacle or kick out the plug, are some of the complications involved.

A typical broadcasting station today has a small staff with each man performing two or more functions. Consequently, in many cases, the play-by-play announcer must be his own engineer.

The amplifier to be described in this article has been termed the "Sports Special." It has prevented some gray hairs and simplified many remote broadcasts at Station WKDK. This unit weighs only 12 lb., including batteries, and is self-contained. It uses four low-drain 1.5-volt "peanut" tubes and small batteries to be described later. Two channels are employed with an extension jack to accommodate the WE 633A microphone, as pictured. The unit is enclosed in a steel cabinet with a sloping front panel, 8" x 8" x 8" in size, which is available as a standard item.

Simplicity is featured throughout the circuit. Two specific characteristics were found to be very desirable. Switch S_1 is ganged to mixer R_2 and breaks the filament supply to that circuit when R_2 is turned off; this in turn conserves battery drain when only one channel is needed. The other characteristic is a relaxation type blinker which indicates the condition of the "B" battery and also serves as an "off and on" indicator. It will be noted that the series resistor to the blinker circuit has a value of 8.2 megohms; therefore, battery consumption is very low.

Schematic diagram and parts values for the amplifier.



The circuit shows one high impedance input. Inasmuch as most broadcast microphones are low impedance devices, the only change necessary to the second channel would be to add transformer. At this station, the second channel is used for crowd noise and utilizes a high impedance microphone, thus saving the cost of another input transformer.

To be dependable, remote broadcast equipment must be rugged. In constructing a unit of this kind, all component parts should be mounted rigidly. In the "Sports Special," it is recommended that all tubes have some form of shock mounting. Most battery tubes tend to be somewhat microphonic when used in high gain circuits, including the output tube.

The "A" batteries are held in place by a spring clip with an insulated contact on the positive end. Two regular flashlight cells are connected in parallel to furnish the "A" supply of 3 volts. A ½-ohm resistor is inserted in series with the "A" voltage supply. This conserves the battery and prolongs the life of the tubes.

The "B" supply consists of two small 45-volt batteries connected in series to give 90 volts. A single 67½-volt battery may be used in some cases, depending on the gain needed. The "B" batteries are held in place in a small compartment.

A bias battery is employed in the output stage (3Q4). This consists of three Penlite cells connected in series to give 4.5 volts. These cells are clamped to the underchassis and should be replaced once each year.

(*Continued on page* 30)

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NEWS BRIEFS

DIELECTRIC TESTER

This dielectric tester, the only one of its kind in the country, was designed and developed by *Anaconda Wire & Cable Company* engineers. It handles

test voltages up to 15,000 volts at the company's Anderson, Indiana, mill during quality control tests on magnet wire which is used in coil windings. Despite the high voltages handled, safety is built into the device; the opening of any one of its several doors will immediately discharge all current.

RADIO SYSTEMS LABORATORY

The Engineering Division of Stanford Research Institute, Stanford, Calif., has revised the organization of its Aircraft Radiation Systems Laboratory. Expansion of industrial services in aircraft and communications programs has necessitated the regrouping of related technical sections under a new arrangement to be known as the Radio Systems Laboratory. Heading the new structure will be Dr. J. V. N. Granger, assistant chairman of the Engineering Department.

The broadened scope of research and development in radio communications at the Institute has also made it desirable to change the name of the Single Sideband Communications Group to the Communications Group. Formerly a separate research section, the Communications Group will henceforth be a part of the Radio Systems Laboratory.

ACCELEROMETER SYMPOSIUM

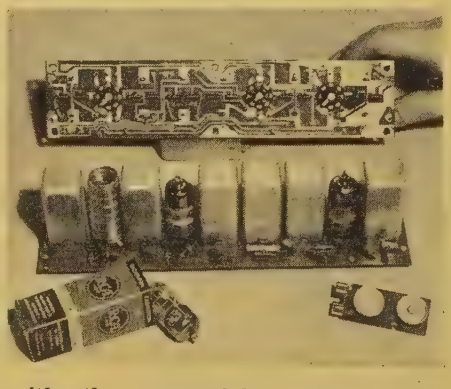
More than 250 scientists and engineers attended a Symposium on Barium Titanate Accelerometers held in Washington, D.C., on May 14 and 15, under the sponsorship of the Office of Basic Instrumentation of the National Bureau of Standards. Sixty-seven industrial and university laboratories were represented as well as 44 U. S. Government agencies and four foreign government agencies; 27 papers were presented and a number of discussion periods were also included.

The advantages of barium titanate accelerometers for the measurement of high frequency vibrations and the relatively low cost at which they can be constructed have caused many organizations to undertake the development of such instruments for particular applications. This Symposium was held so that the various groups could come together for informal discussion of problems of mutual interest, learn more about available data and proposed theories, and resolve or point out inconsistencies between the results obtained by different investigators.

"PACKAGED" I.F. AMPLIFIER

The television industry's first ready-to-use prealigned i.f. amplifier, complete with electron tubes and printed circuit components, has been announced by the Tube Department of the *RCA Victor Division, Radio Corporation of America,* Camden, N. J. It is being offered to manufacturers through the Tube Department's Equipment Sales Section, as a finished package, ready for attachment to the chassis.

Called the "Tandem Amplifier," this unit became commercially practical

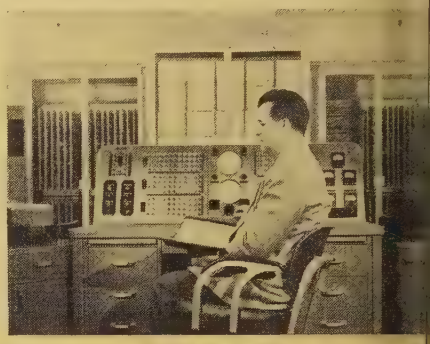


with the successful application of *RCA's* special photo-etch "printing" process for the production of wiring patterns (top) as well as the coils of the individual components (right foreground). It is a three-stage, 40-mc. i.f. assembly designed for TV sets which utilize intercarrier-sound systems having picture-i.f. and sound-i.f. carriers of 45.75 mc. and 41.25 mc. respectively.

NUMERICAL ANALYSIS INSTITUTE

Since its establishment in 1948, the NBS Institute for Numerical Analysis (INA) has not only pursued intensive theoretical studies in those phases of applied mathematics that have been hampered by lack of suitable numerical techniques but has also conducted research in fields related to the design and construction of large scale computers. In the course of this work SWAC (NBS Western Automatic Computer, shown in photograph) has been successfully completed under the sponsorship of the Wright Air Development Center and put into useful operation.

INA provides a computing service for other Government agencies and especially for their contractors in the Southern California area, solving many problems of aircraft design which originate there. It also maintains a consulting service on special problems in applied mathematics and conducts training programs on the theory and application of high-speed automatic computing.



NONHYGROSCOPIC FLUX

According to the *Eutectic Welding Corporation,* Flushing, N. Y., the great majority of corrosion problems normally found in aluminum joining due to the corrosive properties of the slag of conventional fluxes can now be minimized or entirely eliminated with the new Eutector Flux 190NC.

Due to the fact that this flux is non-hygroscopic, it completely eliminates corrosion caused by the absorption of water from the atmosphere which usually occurs when conventional fluxes are used. While in some instances the nature of the slag residue may result in a small degree of corrosive activity the corrosion is but a tiny fraction of what has heretofore been known.

PRODUCING TRANSISTORS

Transistors are now being manufactured on a production line basis

(*Continued on page* 30)

NEW TUBES

MEDIUM-MU TWIN TRIODE

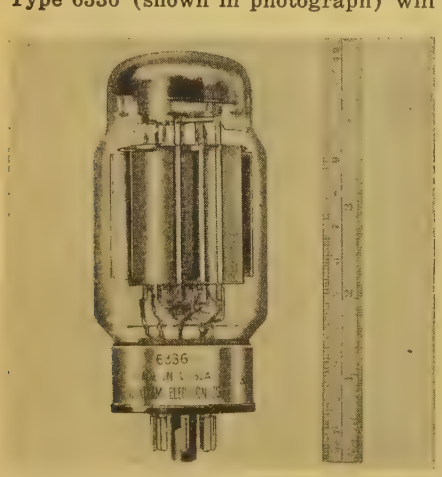
Designed specifically for use as a Class A amplifier and control tube in applications where dependable equipment performance hinges on the ability of electron tubes to take abnormal shock and vibration, the RCA-6101 is a top-drawer version of the RCA-6J6. A medium-mu twin triode, it was developed by the Tube Department of *RCA Victor Division*, Camden, N. J., to meet the need for a tube which would couple 6J6-type characteristics with the ability to withstand the rugged operating conditions of airborne and mobile applications.

Added structural features include: chrome-copper siderods to cool the grids and restrict the development of grid emission; a pure-tungsten heater to provide long life under frequent on-off switching operation; and additional mica insulators to hold parts firmly.

CHATHAM TUBES

Production of two new tubes has been announced by *Chatham Electronics Corporation*—a high perveance, high plate dissipation twin power triode for voltage regulation, and a miniature hydrogen thyratron for pulse generating applications. Complete data on both tubes is available from *Chatham Electronics Corporation*, 630 Mt. Pleasant Avenue, Livingston, N. J.

When used as a series tube, triode Type 6336 (shown in photograph) will



pass a minimum of 150 ma. per section at 40 volts d.c. E_p; with a grid bias of —60 volts, it will pass 150 ma. at 200 volts d.c. E_p. Type 6336 features a hard glass envelope and an eight-pin butt stem.

The new miniature tube, Type VC-1258, is capable of handling peak power up to 10 kw. Designed to fit a standard ceramic miniature socket, it is rated at 1000 peak anode volts, 20 amperes peak anode current, and 40 ma. average anode current. Repetition rates in excess of 10,000 pps are possible at reduced ratings.

"B" PLUS BOOSTER

Workman TV, Inc., Teaneck, N. J., has introduced its new Model 5TV4 "B" plus booster, intended to replace the 5T4G in television receivers to provide greater height, width and gain. It is available for immediate delivery.

A built-in time delay (patent pending) acts as a choke input for the

Model 5TV4. Other advantages include additional filtering and infrequent replacement.

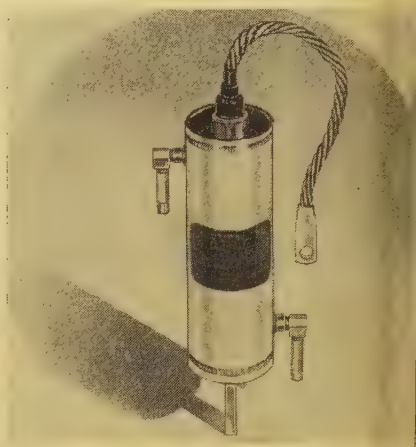
TETRODE AND PENTODE TRANSISTORS

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y., has announced that its development work on tetrode and pentode transistors has progressed to a point at which commercial production is feasible; this company plans to have both units available before the end of the year. In the circuits of a number of potential applications, one tetrode is expected to do the work of two triode transistors, and in some cases, one pentode may do the work of three triodes.

Because these new transistor types have more elements than the triode transistor and will serve as replacements for triodes on a one-for-two or one-for-three basis, they should result in greatly simplified circuitry and permit the building of still more compact electronic equipment. *Sylvania's* bas research work on semiconductor devic is being carried on at its research la oratories at Bayside, N. Y.

IGNITRON

The addition of a new Class B ign tron to the *National* line of industri tubes has been announced by *Nation*



Electronics, Inc., Geneva, Ill. Des nated as NL-5551, this ignitron is metal, water-cooled, mercury-pool t for welder control and similar a.c. c trol applications. Its rating is appr mately equivalent to a 300-amp magnetic contactor.

NL-5551 has a stainless steel, sea welded construction. The mercury-p cathode permits the tube to handle tremely high currents on an intern tent basis.

DECADE COUNTING TUBES

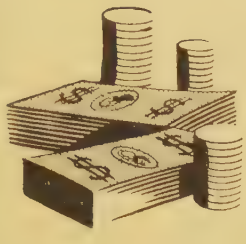
Combining extreme reliability w comparatively high speed and lack moving mechanical parts, the GC1 and GC10B are said to represent advance in the direction of simpli counting circuitry. They are both c cathode, bi-directional, glow trans counting tubes which have been ad to the series being distributed *Atomic Instrument Company* for *Er son Telephones, Ltd.*

GC10M is a miniature tube desig for use in medium-speed decimal co ing apparatus such as scalers, c puters and dividers. Maximum in frequency is 600 pps, and output v age developed across cathode resistc 15 volts. GC10B operates at a m mum input frequency of 4000 pps; count is determined by noting the p tion of the glow on any one of the radially spaced cathodes around axially positioned anode.

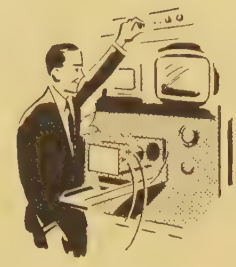
Further information on these de counting tubes may be obtained f Dept. GC-1, *Atomic Instrument C pany*, 84 Massachusetts Avenue, C bridge, Mass.

What means most to an Engineer?

PROFESSIONAL RECOGNITION



GOOD SALARY



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A Career at RCA offers all Four!

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itions are open in research, develop-nt, design and application. Long ge work in many fields is being car-d on both for commercial develop-nts and military projects for war d peace.

RCA you'll work in an exciting pro-sional atmosphere, with technical l laboratory facilities unsurpassed where in the radio-electronic indus-. You are in close and constant association with leading scientists and engineers. Individual accomplishment is not only recognized, it is sought out. Delightful suburban living is easily available for your family. And there's ample opportunity for income and position advancement.

Plus, Company-paid hospitalization for you and your family . . . accident and life insurance . . . progressive retirement plan . . . fine recreational program . . . modern tuition-refund plan at recognized universities for advanced study.

Join the team at RCA, world leader in electronic development, first in radio, first in recorded music, first in television. Rest easy in the knowledge that your future is secure, the rewards many and varied.

Personal interviews arranged in your city.
Please send a complete resume of your education and experience to:

MR. ROBERT E. McQUISTON, Manager
Specialized Employment Division, Dept. 204-J
Radio Corporation of America
30 Rockefeller Plaza, New York 20, N.Y.

***Positions Open In:* RESEARCH—DEVELOPMENT—DESIGN—APPLICATION**
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RADAR—Circuitry—Antenna Design—Servo Systems—Information Display Systems—Gear Trains—Stable Elements—Intricate Mechanisms

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MISSILE GUIDANCE—Systems Planning and Design—Radar and Fire Control—Servo Mechanisms—Vibration and Shock Problems

NAVIGATIONAL AIDS—Loran—Shoran—Altimeters—Airborne Radar

TELEVISION DEVELOPMENT—Receivers—Transmitters and Studio Equipment

COMPONENT PARTS—Transformer—Coil—Relay—Capacitor—Switch—Motor—Resistor

ELECTRONIC TUBE DEVELOPMENT—Receiving—Transmitting—Cathode-Ray—Phototubes and Magnetrons

ELECTRONIC EQUIPMENT FIELD ENGINEERS — Specialists for domestic and overseas assignment on military electronic communications and detection gear.

RADIO CORPORATION of AMERICA

NEW PRODUCTS

VARIABLE IMPEDANCE WATTMETER

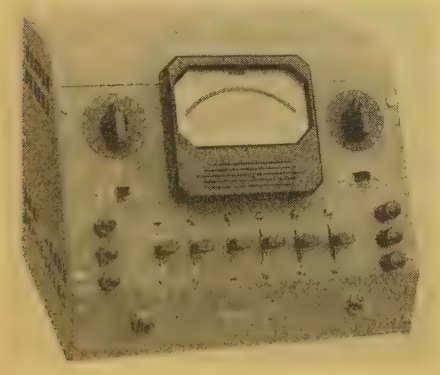
Fast, accurate power measurements between 2 and 30 mc. are possible with the variable impedance wattmeter which has been announced by *Sierra*

Electronic Corporation, 1049 Brittan Avenue, San Carlos 2, Calif. Designating its input impedance as $Z = R + jX$, R can be adjusted over a broad range of 5 to 500 ohms and jX can be adjusted between $\pm$ 250 ohms. Up to 250 watts of power may be dissipated, and over-all accuracy of the power measurement is within 10%. Accuracy of impedance magnitude is within 5%.

The Model 141 is simple to operate. Correct impedance is established for each frequency by setting three counter type dials in accordance with an easily read calibration book. Power is read directly on a large front panel meter.

TRANSISTOR TESTER

Here is an instrument which affords a means of testing transistors, diodes, and other semiconductor devices on a direct-reading "go no-go" basis. The Model TT-11 transistor tester, being marketed by *Electronic Research Associates, Inc.*, Box 29, Caldwell, N. J., utilizes a bridge method for comparing the characteristics of the unknown with a known reference transistor. Variation from standard for a given test is read directly on a calibrated "good-bad" meter scale.



Both static and dynamic tests are performed, and results are independent of voltage and temperature variations. Static tests are made on forward diode (emitter-base) characteristics and reverse diode (collector-base) characteristics. Dynamic testing includes both amplifying and oscillation condition comparison with the reference transistor.

ALLOY PASTE SOLDERS

Use of the HR electrical series of paste solder alloys recently announced by *Fusion Engineering* eliminates the separate fluxing operations encountered

with preforms, foil or wire. Due to the fact that the flux is incorporated in the alloy with the solder, the paste may be preapplied semiautomatically or automatically by unskilled help and heated with automatic equipment.

Designed for electronic connections, the HR series is suitable for transistor and diode soldering and printed circuits as well as for general electronic applications. An activated high-rosin flux is used to prevent corrosion. Further information concerning these paste alloys, available temperature ranges, and application methods may be obtained by writing to *Fusion Engineering*, 4504 Superior Avenue, Cleveland 3, Ohio.

PULSE GENERATOR

Wide ranges of pulse duration, amplitude, recurrence rate and positioning are provided with the Model PG-200A pulse generator—a medium-power precision instrument for generating adjustable rectangular waveforms having fast rise and decay times. It may operated as a self-synchronous unit driven by an external signal of almo any waveform.

Pulse width and pulse position wi respect to the sync output trigger a continuously variable from .05 to μsec. by means of calibrated contro Rise and decay times of pulse consta

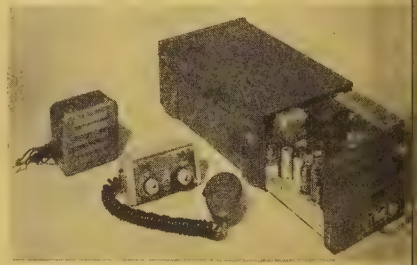
are equal to .03 μsec. or less from to 1000 μsec. pulse width. Pulse repe tion rate is from 1 to 20,000 pulses p second.

All inquiries on the Model PG-20 should be addressed to Department *Teletronics Laboratory, Inc.*, 54 Kin Street, Westbury, L. I., N. Y.

MOBILE TWO-WAY RADIO SETS

Additions to the *Motorola* line of 54 mc. FM two-way radio equipment clude the T41G series, having a no inal r.f. power output of 30 watts (photograph), and the T51G series, h ing a nominal 60-watt r.f. output. Th mobile models feature such innovati as universal 6-12 v.d.c. operation, d interrupter vibrator power supply, a drastically reduced power drain.

Use of a newly developed all-vibra power supply results in an over drain reduction of almost 50%; wh operating from a 6-volt battery, the watt model requires 10.5 amperes



standby and only 43 amperes dur transmit periods. Power drain of 30-watt unit is approximately equa that of a conventional 10-watt transr ter-receiver combination. For furt information, contact *Motorola I* Communications & Electronics Divis Technical Information Center, 4545 Augusta Blvd., Chicago 51, Ill.

MINIATURE SHIELDS

The Staver Company, Inc., ma facturer of electronic specialties,

unced a new series of "Mini-lds" designed for shielding minia- tubes in printed circuits. Like the lard "Mini-Shields," the 400 es minimizes vibration and provides r operation.

e principal design change in the Series is a flared bottom which s each shield to pass over the nd lug of the printed socket easily. holds the shield firmly in place and res contact between shield and nd. For complete details and speci-ions, write to *The Staver Company*, 41-51 North Saxon Avenue, Bay e, L. I., N. Y.

ARE WAVE GENERATOR

signed to fill the need for a pre- n square wave generator conveni- to use, yet moderately priced, the *SKL* Model 504 produces square e voltages without tilt or overshoot. remely short rise time (less than 30

imicroseconds) makes the unit ideal testing the response of audio, i.f., and video amplifiers. Calibrated age is continuously variable from 11 volts.

he Model 504 has a frequency ch with nine positions: the first permits operation at any frequency rmined by an external capacitor, le the remaining seven positions vide frequencies from 0.5 cps to 000 cps in decade steps. For further rmation, write to *Spencer-Kennedy oratories, Inc.*, 186 Massachusetts nue, Cambridge 39, Mass.

IABLE REJECTION FILTER

Model 360-A, an adjustable rejection r recently announced by the *Krohn-e Instrument Company*, provides er a rejection band in which the n falls at a rate of 24 db per octave a sharp single frequency null. A king factor is used to reduce the nuation at the cutoff frequencies. s both the high and low cutoff fre-ncies are independently adjustable n 20 cps to 200 kc., the rejection dwidth is continuously variable up

(*Continued on page* 31)

LOOKING at TUBES

By WILFRID B. WHALLEY
Adjunct Professor of Electrical Engineering
Brooklyn Polytechnic Institute

Single-gun tricolor tubes for color television.

SEVERAL designs of three-gun tricolor picture tubes were discussed last month. All presented various problems, the most serious being the difficulty of maintaining registration of the three electron beams over the whole picture area. Therefore, many engineers have tried to develop suitable single-gun tricolor picture tubes, not only for the sake of simplicity and lower cost, but to minimize or eliminate the problem of maintaining registration.

Single-gun tubes cannot give light output simultaneously in all three primary colors. However, it is gradually being realized that color signals which are generated and received by subcarrier modulation (in one form or another of "simultaneous color") can readily be modified in the receiver to give color signals in sequential form at a suitable switching rate. Hence, all presently known color television systems can make use of correctly designed single-gun tricolor tubes.

Methods of Color Control

Many ingenious methods of color control have been proposed. These have included: changing the color of the emitted light by changing the velocity of the electron beam; making the color screen from a sandwich of alternate phosphors and insulated mesh grids; and modifying the aperture "mask" type of tube to use one electron gun. Each of these three proposals presents fundamental problems and has its limitations.

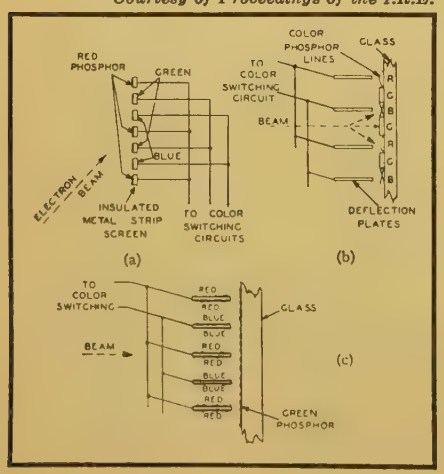
Electron velocity changes produced by changes in the second anode voltage require compensating changes in the horizontal and vertical scanning fields to maintain the same picture size. Changing the scanning amplitudes without some undesired change in waveform is difficult. Also, as large voltage changes are needed to obtain appreciable color differences, high power at high voltages would be required.

A tube with a color screen of alternate phosphors and wire grids has a narrow viewing angle. This is due to the elements of the picture of one color being displaced in depth (sandwich thickness) from the elements of another color.

In the single-gun type of aperture "mask" tube, the screen depends for color control upon the angle of arrival of the electron beam. The correct angle is obtained by rotating the electron beam about the axis of the tube with an auxiliary two-phase sinusoidal deflection field positioned ahead of the scanning yoke. With such a tube, a basic problem exists in that the electrons must be made to pass through the same aperture at all points of the screen for each angular position of the rotating field. Since the mask collects more than 80 per cent of the electrons, the light output is also quite low.

Fig. 1. Beam control at phosphor screen for changing color. (A) Simple line-screen color switching. (B) Deflection switching of colors with line screen. (C) Deflection switching without need for registry.

Courtesy of Proceedings of the I.R.E.



Insulated Sectional Screen

Another suggestion was to fabricate the phosphor screen out of a woven mesh of three insulated phosphor-coated conductors, and bring the leads out to three terminals as indicated in Fig. 1A. If one conductor were placed at normal second anode voltage while the other two were at zero or slightly negative potentials, then the electrons in the scanning beam would be collected only by the first conductor. Since each conductor in the mesh would be successively at the same second anode voltage, no change in scanning amplitudes would be necessary, and there would be no problem of registration. However, it is quite difficult to insulate a finely woven mesh for voltages of 15 to 18 kv., and to switch such large voltages would require expensive circuits.

Screen Deflection Control

In the woven screen proposal, the point of arrival of the electron beam can be determined only by switching high voltages. If the electrons could be influenced by a suitable field over a longer path, the control voltage would be smaller.

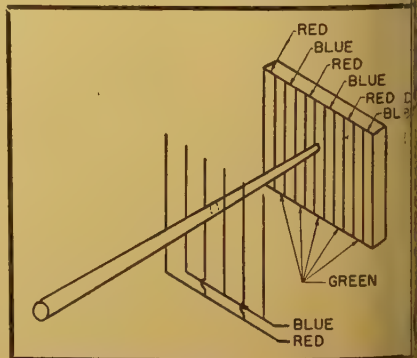
This suggests a better method of controlling color in which a structure, consisting of a large number of parallel conducting strips, is placed near the phosphor screen and interconnected so that all of the odd-numbered strips are brought out to one auxiliary terminal while the even-numbered strips are tied to a second terminal. If the average potential of the assembly is the same as that of the phosphor screen, and the even strips are made positive with respect to the odd strips, then an electron beam passing to the tube face will be bent in one direction.

As sketched in Fig. 1C, some experimental tubes with this type of color deflection control had two of the color phosphors on opposite faces of the strips, while the third color phosphor was in the usual position at the face of the tube. With typical second anode operating voltages, a voltage difference between the deflection plates of only a few hundred volts is sufficient for color switching. When the voltage difference is zero, the electrons excite the phosphor which is on the face of the tube.

Such a tube can give positive control of color, and is relatively simple to construct. However, there is loss of light from those phosphors which are located on the metal strips, due to passage through the third phosphor coating on the screen. Even with a thinly settled green phosphor, superimposed on the necessary thin conducting film, the light loss is appreciable.

Fig. 2. Sketch showing focusing action of an electrostatic cylindrical lens.

Courtesy of Proceedings of the I.R.E.



way of avoiding this loss of light be to place the color phosphors in ate strips on the face of the tube, wn in Fig. 1B, and align the de- n structure so that there would be sections of phosphor between each f deflection plates. Tubes of this have been constructed, but are d in resolution (in the direction deflecting field) since each color must be wider than the diameter electron beam.

ence Tube

E. O. Lawrence proposed a valu- odification of deflection color con- n his design, the control structure nposed of a large number of thin mounted under tension on an ted rectangular metal frame. creen is made up of a correspond- number of phosphor strips, as n in Fig. 2. Further, the wire ure is placed a short distance from the phosphor surface and is ted at an average voltage much than the phosphor. Typical volt- are 4.5 kv. for the control struc- nd 18 kv. for the phosphor. sume that the wires in the grid ure are all at the same 4.5-kv. tial. The electron beam, in pass- will not receive any added deflec- but will continue on toward one of the green phosphor strips. After entering the region beyond the wire structure, the electrons will be accelerated and also focused by the lens system formed between the parallel wires and the much higher voltage phosphor screen. This focusing action reduces the beam dimension in a direction perpendicular to the phosphor strips.

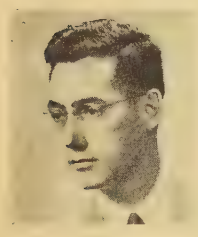
The fact that the electron beam at arrival is reduced in size makes possible a tube having a large number of alternate red, green and blue strips, and having a resolution in all colors comparable to the number of writing lines used in normal television scanning. A further advantage is that the wire structure has somewhat lower capacity than a strip type of structure, and at the same time controls electrons traveling at only one-quarter of the usual monochrome tube velocity (4.5 kv., as compared to 18 kv.). A peak-to-peak voltage of about 500 is sufficient to shift from green to red, or—with the opposite polarity—from green to blue.

It will also be realized that the power required for horizontal and vertical scanning of this type of tube is much less than that required for standard monochrome picture tubes.

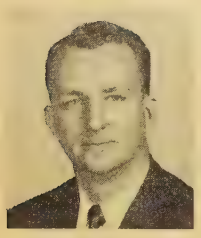
Since the control structure capacity is moderate, and the maximum required voltage difference is only 500, color switching is possible at frequencies up in the megacycle range. At such frequencies, the capacity of the structure is resonated with a suitable inductance, and the tube can be controlled by sinusoidal waveforms in combination with correct modulation voltages on the cathode or grid of the electron gun. At low switching speeds, such as for field sequential color systems, the power required for color control is negligible. In fact, three miniature receiving type tubes are adequate for generating the waveforms and driving the wire structure.

Due to the use of thin wires, the electron-light output efficiency is very high, being approximately 90%. Hence, this type of single-gun tube gives bright pictures with beam currents the same or less than required by monochrome tubes. By constructing the phosphor screen so that the spacings between the phosphor lines increase slowly toward the edges of the picture, this type of tube can be made as short as a typical black-and-white tube for the same area of picture. With the wire structure correctly aligned, and this is necessary only in the dimension parallel to the phosphor strips, there is no problem of registration of the color images as in other types of color tubes—especially those having three guns.

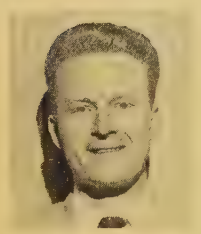
Personals



IRVING J. ABEND will head the newly formed Applications Engineering Department of the *General Ceramics and Steatite Corporation*, Keasbey, N. J. Mr. Abend has had 17 years of experience in the development and production of electronic, communications, radar and nucleonic equipment. Formerly chief engineer of the *Freed Radio Corporation*, he has also been associated with *Air Associates, International Detrola Corporation*, and the *David Bogen Company*.



WILLIAM C. COTHRON, TV station engineering specialist, has been employed by the consultant firm of *Unitel, Inc.*, 205 East 42nd Street, New York, N. Y. Mr. Cothron's duties will take him to Tokyo, Japan, where he will supervise the installation of the first of the chain of TV relay stations being sponsored by the *Nippon Television Network Corporation*. Prior to joining *Unitel, Inc.*, he was with *Allen B. Du Mont Laboratories* and *Radio Corporation of America*.



OSCAR F. HAUG is the project engineer for the "Ultra-Viscoson," ultrasonic instrument for measuring viscosities of fluids. Formerly a design and development engineer of guided missile electronic components at the Research Laboratories of *Bendix Aviation Corporation* in Detroit, Mr. Haug now moves to the company's Cincinnati Division to handle engineering for volume production of this new instrument. He served in the Air Force during World War II.

LEON PODOLSKY has been appointed chairman of a new committee organized by the American Standards Association in the field of electronic components—Sectional Committee C83—in the Communications Division of the ASA Electrical Standards Board. Mr. Podolsky, who is technical assistant to the president of *Sprague Electric Company*, is also chairman of RETMA's International Standards Committee and a member of various other engineering societies.

KENNETH M. UGLOW has opened an engineering office at 1507 M Street, N. W., Washington, D. C., to provide planning, design, and analysis on radio communication, telemetering, and radar systems, as well as consulting service for development engineering groups. From 1943 to 1946, Mr. Uglow was engaged in microwave radar development for the *General Electric Company;* since then he has been an electronics consultant at the Naval Research Laboratory.

HERMAN L. WECKLER, who was vice-president, general manager, and a director of *Chrysler Corporation* for 13 years until his retirement in April, has now been elected vice president-operations of the *Clevite Corporation*. In his new post, he will have general responsibility for the operations of *Clevite Corporation's* manufacturing and selling units, including *Cleveland Graphite Bronze Company, Brush Electronics Company, Harris Products Company*, etc.

Developments at NBS

(*Continued from page* 15)

Using a capacitance-type pickup a resonant-bridge carrier system, micromanometer depends on the a and thinness of the diaphragm and the sensitivity of the electronic circ for its high resolution. Deflections of order of one millionth of an inch (scale) and capacitance changes 0.005 $\mu\mu$fd. are involved. In resolut and sensitivity, the NBS micromano eter shows a decided improvement o other devices also designed to meas static and semistatic differential p sures with the aid of diaphragms.

Tube Vibrator

Electronic equipment is being ca upon increasingly for applicati where it can be subjected to sev shock and vibration, and engineers h had to develop special compone rugged enough to withstand such str uous service. Electron tubes preser particular problem from the standp of severe vibration. In addition being strong enough not to fail chanically, an electron tube must low in microphonics; spurious elec cal signals generated by vibration the tube must be low in relation to desired signal that the tube must h dle. In ordinary receiving tubes, mi phonics may easily be a thousand even a million times greater than intrinsic tube noise. In miniatur equipment, tube microphonics can b very difficult problem.

An improved wide-range vibra generator is facilitating the study low-microphonic tubes in the Electron Tubes Laboratory. Rece developed by J. D. Rosenberg, W Hillstrom, and L. T. Fleming, this vibrator produces accelerations up 20 times that of gravity and is within 20% over the unusually range of 100 to 10,000 cps. The under study is fitted into a hole in vibrator's moving element—or ar ture—which is a cylindrical block nonmagnetic material with a "v coil" for the a.f. driving voltage a lower end. Two flexible metal st hold the armature centered in an tromagnetic field structure powere 40 watts of 120-volt direct cur Although the only model of the vibr thus far constructed was built to commodate subminiature-type t the design could readily be modifie microphonic studies of miniature octal tubes. The complete unit is sh in Fig. 3.

In this vibrator, the upper frequ limit is raised over that of commer ly available units by making the a ture simple and rugged, out of a

having a high ratio of rigidity ght. Linen bakelite, which is oderately good in this respect, ed for the present armature be- f its convenience and availabil- ndamental resonance occurs in ghborhood of 18,000 cycles; re- begins to rise at about 10,000 The use of a material with a rigidity-to-weight ratio would tially raise the frequency of nental resonance, and thus the limit of flat response.

lopment of the tube vibrator was ent upon the previous develop- f a small barium titanate accel- er capable of measuring vibra- equencies to 20 kc. at acceleration of 0.2 to 10,000*G*. One of these ometers is mounted on the arma- the vibrator to sense the vibra- nplitude.

her barium titanate accelerom- similar in shape and weight to subminiature tube, was developed sly to meet needs arising in the ment of the vibrator. A con- t tube holder had to be designed e vibrator which would be suffi- free from stray compliances and nces to assure that the motion of be would conform closely to the of the vibrator up to at least The subminiature-tube-type ac- meter facilitated the design of tube holder.

owave Antenna

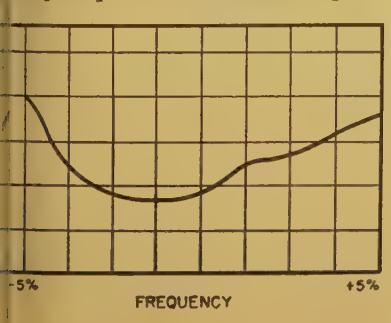
inued from page 13)

arrive at the matched condition e entire array, a slot length was d which produced a normalized ance value of 0.25. Four of these ies would then present a normal- npedance of $1.0 + j1.6$, the reac- mponent of which is easily can- by correctly placing the series circuit at the end of the antenna. ver, this short-circuited section of ill develop an incremental react- pposite in sign to that of the ra- g elements as the frequency is va- thus producing desirable broad- properties. Figure 4 is a plot of R vs. frequency for the array.

ssurizing was accomplished by cementing small polystyrene beads in the line to seal the slots, resulting in a negligible impedance disturbance. The slot widths had previously been designed to handle the required magnetron power, so that no voltage breakdown trouble was experienced.

A photograph of the array is shown as Fig. 1, indicating very closely the essential simplicity of this antenna.

4. Voltage standing-wave ratio frequency for final antenna array.



Gain Rider

(*Continued from page* 8)

a 2.5-db increase in compression of the amplifier's output signal. This is the result of lowering the difference in attenuator tube plate voltage during varying degrees of compression.

Eliminating R_8, the voltage at the attenuator plate will rise from 37 to 112 volts for a compression extreme of 0 to 15 db. Including R_8 in the circuit, the minimum to maximum voltage is 27 to 65 volts.

Outside of standard low-level wiring practices, there is no need for any special caution in wiring the unit; R_2 and C_2 should be located close to the 6K7 grid terminal board, however.

Selection of a quiet tube for the first stage of the amplifier may be necessary due to noise originating in this stage. On low program passages and silence, this tube will raise the noise level in the amplifier's output by the amount of compression employed.

R_1, a step-type attenuator equipped with detent, was installed to replace the small carbon potentiometer with which the amplifier came equipped, as experience showed that this control could be accidentally kicked open or shut during an unattended broadcast.

Attenuation in the H-pad from the output of the amplifier should be selected according to the level intended to be fed to the line. With 23 volts of positive bias to overcome on the audio rectifier before compression begins, the level across the line winding of the output transformer at this point will rise to approximately + 17 db. At this station, a 15-db attenuation pad was chosen which allows the amplifier to feed to the line levels of approximately + 2 db at the threshold of compression to + 6.75 db with the amplifier under 15 db of compression.

Provided that an instantaneous attack time is not essential, it is believed that this simple method of gain control can be used effectively in almost any audio equipment requiring automatic gain control of the output level.

NEW LITERATURE

RADIO REMOTE CONTROL

The practical application of radio remote control for electric industrial trucks and tractors is demonstrated in Bulletin No. 534, a copy of which may be obtained from *Barrett-Cravens Co.*, 4609 South Western Blvd., Chicago 9, Ill.

Photographs taken in a large food products warehouse show how a substantial amount of time can be saved in the movement of materials and goods by the remote control system called "Radox." Orders can be filled more rapidly and worker fatigue is greatly reduced.

PLASTIC COMPONENTS

Various types of precision-machined plastic components are described and illustrated in the four-page brochure being offered by the *Tri-Point Manufacturing and Developing Co.*, 401 Grand Street, Brooklyn 11, N. Y. Included are such plastics as Teflon, KelF, Nylon, Formica, Rexolite, Polystyrene, Polyethylene and laminated phenolics. Tolerances of .001" are held on production runs of components made in standard sizes or to specifications.

CABLES

"Federal Quality Controlled Cables" is the title of a 28-page catalog which may be obtained by writing to the Selenium-Intelin Department, *Federal Telephone and Radio Corporation*, a division of *International Telephone and Telegraph Corporation*, 100 Kingsland Road, Clifton, N. J.

Among the topics covered in this catalog are the various cable types and components, cable production, TV transmission lines, and community TV lead-ins. Also included are two-way cable selection tables, impedance nomographs and a reel selection guide.

VACUUM IMPREGNATION

A revised edition of a 24-page brochure on "Vacuum Impregnation" has just been released by *F. J. Stokes Machine Company*. It presents in detail the versatile process by means of which voids in porous materials are filled with a desired impregnant after air and moisture have been evacuated. Applications include: the sealing of metal castings against microporosity, improvement of dielectric efficiency in electrical components, and the potting of transistors.

Copies of Catalog No. 760 may be obtained free on request to *F. J. Stokes Machine Company*, 5500 Tabor Road, Philadelphia 20, Pa.

WIRE FORMED PARTS

Pix Manufacturing Company, Inc., 22 Bedford Street, Newark, N. J., has announced the availability of a 16-page, two-color catalog on wire formed parts and stampings. Profusely illustrated, it shows delicate wire formings ranging from .002" in diameter to .156" in diameter, and stampings having a thickness of from .005" to .125", with diameters of ¼" to 3". Many different metals and alloys are used in the production of these parts.

ELECTRONIC INSTRUMENTS

Manson Laboratories has just released an eight-page booklet outlining its facilities for the design and production of special electronic and electromechanical instruments for laboratory and industrial use. A number of products are illustrated and pertinent data are given regarding specifications and performance.

Copies of the prospectus and further information can be had on request to *Manson Laboratories*, 207 Greenwich Avenue, Stamford, Conn.

VIBRATION ISOLATOR

Barry Product Bulletin 532 presents technical and performance data on the new Type 915 "Barrymount"—an isolator of vibration and noise caused by motor generator sets, high-speed compressors, grinders, fans, blowers, and similar equipment.

Published by *The Barry Corporation*, 870 Pleasant Street, Watertown 72, Mass., this bulletin discusses the installation of the Type 915 isolator and gives complete data on load ranges, physical dimensions, isolation efficiency at various frequencies, and variation of natural frequency over the range of rated loads.

TV TUBE COMPONENTS

Tungsten and chemical components for television picture tubes are described in a four-page booklet available on request from the Tungsten and Chemical Division, *Sylvania Electric Products Inc.*, Towanda, Pa.

Among the components covered are screen phosphors, potassium silicate for screen settling, tungsten wire for cathode heaters, and triple carbonate cathode coatings. A description of stranded tungsten coils and filaments for vacuum metalizing (used in the minimizing of picture tube screens) is also given.

MEASURING EQUIPMENT

GEC-1016A is a revised edition of *G-E*'s 64-page measuring equipment catalog. Containing information on more than 115 testing and measuring devices for laboratory and production line use, it is now available from *General Electric Company*, Schenectady 5, N. Y.

Products covered in this fully illustrated publication range from sine current indicators to completely automatic oscillographs; from surface roughness scales to mass spectrometers and from d.c. amplifiers to radiation monitors.

VACUUM FURNACES

In a four-page bulletin issued the *F. J. Stokes Machine Company* a number of processes now being carried out in the building of three

um furnaces are discussed in de-
titled "Vacuum Furnaces and
pplication to the High-Vacuum
ing of Metals," Catalog No. 770
nts out the advantages of vacu-
naces for commercial use and
types currently available from
npany.
opies of Catalog No. 770, write
Stokes Machine Company, Vacu-
uipment Division, 5500 Tabor
hiladelphia 20, Pa.

Transmission

ued from page 12)

ngle-sideband equipment with
-carrier demodulation; equip-
f this type has been referred to
sly[1].
a single-sideband suppressed-
signal is being interfered with
ther SSSC signal of the same
h, within 30 cycles of the same
" frequency, both signals are
ible provided that both are
itting the same sideband. The
eterodyne, characteristic of two
ring AM signals, is absent re-
s of the frequency separation
SSSC signals. Without the dis-
g heterodyne, the ear is readily
discriminate against the un-
signal. The effect is much the
s that noted in a crowded room
several people are talking at
ne time and at about the same
s; it is nearly always possible
ract the desired conversation.
the two signals are of unequal
the discrimination properties of
r are impaired; however, ex-
e has shown that differences of
ch as 10 db still provide fair
libility of the weaker signal. If
o transmissions are on opposite
ds, the selectivity of a single-
nd receiver of the type mentioned
ovide 30 db or more rejection of
ndesired signal; it is readily
e for two stations on the same
r" frequency to operate on dif-
sidebands without mutual inter-
.
rference between two SSSC sig-
adjacent channels, i.e., within 3
. of each other, with both trans-
the same sideband, results in
nal being unintelligible when the
r is properly tuned to the other.
these conditions, the discrimina-
roperties of the ear are substan-
mproved over the cochannel case,
e signals may differ in level by
20 db before the weaker one be-
unreadable.
conventional AM transmission,
ularly at the lower frequencies,
fation conditions are frequently
hat the carrier fades and in some cases practically vanishes while the sidebands remain relatively unaffected —resulting in a particularly severe form of audio distortion at the receiver. In SSSC, using exalted-carrier receiving equipment, this effect is not present. Hence, readability can usually be maintained to a considerably lower signal level than is normally possible with double-sideband AM. Certain short time-constant a.v.c. circuits tend to minimize sudden or large changes in audio level which result from fading of the single-sideband signal.

As pointed out earlier, in SSSC reception the receiver bandwidth may be effectively one-half that required for the equivalent double-sideband AM signal without deterioration of the higher frequency sideband components. Noise and atmospheric disturbances may be considered as uniformly spread over a relatively wide band insofar as the actual communication channel is concerned. Halving the receiver bandwidth will effectively halve the noise voltage accepted by the receiver without in any way affecting the received signal. The signal-to-noise ratio is improved by some 6 db, which more than makes up for the small loss incurred through elimination of the sideband at the demodulator.

REFERENCES:

1. *Moses, R. C., "Exalted-Carrier Single-Sideband Reception,"* RADIO-ELECTRONIC ENGINEERING, *March*, 1952.
2. *Dome, R. B., "Wide Band Phase Shift Networks," Electronics, December*, 1946.
3. *Nibbe, G. H., "Audio Phase-Shift Networks," QST, January*, 1950.

CALENDAR of Coming Events

SEPTEMBER 28-30—National Electronics Conference, Hotel Sherman, Chicago, Ill.

OCTOBER 5-8—Fall Technical Meeting of USA and Canadian National Committees of URSI and the IRE Professional Group on Antennas and Propagation, National Research Council, Ottawa, Canada.

OCTOBER 14-17—Audio Fair and Audio Engineering Society Convention, Hotel New Yorker, New York, N. Y.

OCTOBER 26-28—IRE-RTMA Radio Fall Meeting, Toronto, Ontario.

NOVEMBER 13-14—Annual Electronics Conference, Kansas City Section, IRE, Hotel President, Kansas City, Mo.

NOVEMBER 18-20 — Joint IRE-AIEE Sixth Annual Conference on Electronic Instrumentation in Medicine and Nucleonics, New York, N. Y.

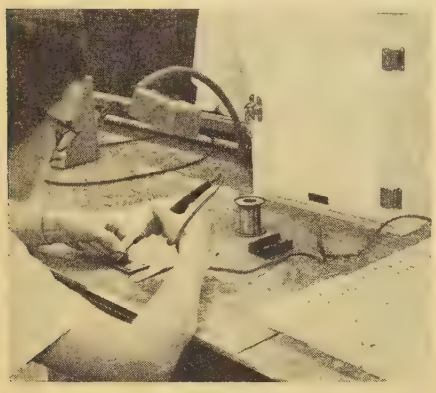
FEBRUARY 4-6, 1954 — Sixth Southwestern Conference and Electronics Show, Tulsa, Okla.

MARCH 22-25, 1954—Radio Engineering Show and IRE National Convention, Kingsbridge Armory and Waldorf-Astoria Hotel, New York, N. Y.

News Briefs

(*Continued from page* 18)

Sylvania Electric Products Inc. This member of a *Sylvania* production team is shown soldering a wafer of germanium to a triode transistor mounting post. After a delicate lead wire is attached to a dot of the rare metal, the assembly job is completed except for capping and hermetically sealing the transistor.



SILICON ALLOY DIODE

Revolutionary advances in telephone switching systems and in many kinds of computers may result from the new electronic device which has been created by *Bell Telephone Laboratories*. Described as a silicon alloy junction diode, it serves as the electronic equivalent of a tiny one-way switch, thus acting as a rectifier, and is capable of operating thousands of times faster than its mechanical counterparts.

Like the transistor, the silicon alloy diode requires no warm-up period. But unlike the present germanium transistor or diode, it can operate well under high temperatures. The ratio of its resistances is 100,000,000 to 1. Production problems are being worked out with the *Western Electric Company*, manufacturing unit of the *Bell System*.

Remote Amplifier

(*Continued from page* 16)

In operating the "Sports Special," better low frequency response has been noted when the primary of the output transformer is isolated from the d.c. current. The isolating choke is the primary of a midget universal output transformer. The blinker circuit makes use of a NE51 bulb; C_1 determines the rate of flashing, and this condenser must have a minimum of leakage.

No feedback scheme was employed in this circuit, as the over-all gain is not enough to allow for inverse feedback. Nevertheless, the frequency response is excellent, being of the order of 50-12,000 cps ± 1 db. Of course, the response depends on the transformers used. Distortion measurements indicate the percentage to be well below 5% at 0 db and 50-12,000 cps. Battery life is normally 25 hours or more.

Extension wire for the telephone line is wound on two ears mounted on the back of the unit. With the WE 633 microphone plugged in, only headphones and a screwdriver are needed for a remote pickup. This remote amplifier has proven dependable in every respect at WKDK for the past two years.

TECHNICA BOOKS

"FUNDAMENTALS OF ELECTRO MOTION" by Willis W. Harman, A. ciate Professor of Electrical Engin ing, Stanford University. Publishe *McGraw-Hill Book Company, Inc.*, West 42nd Street, New York 36, N 319 pages. $6.50.

This is a book for the user of elec tubes—for the student whose prim aim is to gain general understan rather than specialized informatio contains the essential philosophy of tron tube analysis.

In the first chapter, the basic which govern the motions of free trons are reviewed and summarized. remainder of the book is then conce with their application in determi electron motions under various circ stances, and from this knowledge, i riving the external, measurable cha teristics of electronic devices. Emp throughout is not on the devices t selves but upon the methods emp in their analysis.

The numerous problems form a important part of the book. No in knowledge of mathematics beyond culus is assumed, however; the ma matical techniques are explained as are needed.

"CIRCUIT THEORY OF ELECTRON VICES" by E. Milton Boone, Profe of Electrical Engineering, The State University. Published by *Wiley & Sons, Inc.*, 440 Fourth Ave New York 16, N. Y. 483 pages. $8.

Most of the material included in book has been used during the past years in note form by students enr in the engineering and enginee physics curricula at The Ohio University. It is sufficient for a semester course.

Fundamental emphasis is on ci theory and not on the physics of elec devices inasmuch as the author beli that for the beginning student ana should be limited at first to the ci properties of the electron devices—p erties that can be determined by m urements at available terminals. electron and ion physics is neces but this material has been integrat the circuit theory.

The vacuum tube and the trans as operated in the linear region of characteristics have been treate four-terminal networks using the eral admittance or impedance pa eters of four-pole theory. A com chapter is included on the linear ci theory of transistors.

Products

nued from page 23)

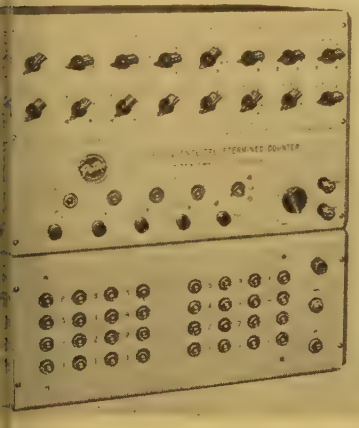
imum width covering this entire
The sharp null may be obtained
frequency from 100 cps to 50 kc.
filter is useful for any audio or
nic work requiring selective am-
on and for stabilization of a.c.
A descriptive pamphlet is avail-
request from *Krohn-Hite In-
nt Company*, 580 Massachusetts
, Cambridge 39, Mass.

OKE

rporation of a high-permeability
core in the newly developed
" r.f. choke has provided a
aving excellent operating char-
tics and extremely small size.
nounced by the *Grayburne Cor-
n*, 4-6 Radford Place, Yonkers,
it is especially recommended for
computer circuits and other ap-
ons where component size is a
l factor.
trical characteristics of the
" choke are as follows: d.c.
nce—120 ohms; inductance—25
± 5%; distributed capacity—8
Q at 100 kc.—115; *Q* at 450 kc.
and current-carrying capacity—
.

TERMINED COUNTER

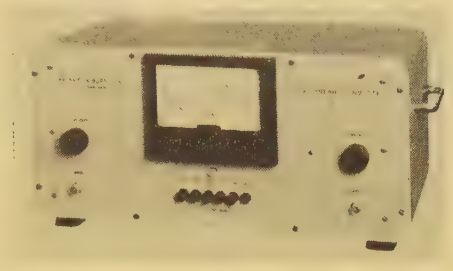
ersatile electronic predetermined
r has been designed by the *Potter
ment Company*, 115 Cutter Mill



Great Neck, N. Y., for use wher-
precise, multiple-sequence control
nufacturing processes is desired.
ased production and reduced spoil-
an be achieved with this counter
se it is possible to govern the op-
n of production machinery in
of linear measurement, shaft
tions, quantity, volume, or weight
erational speeds as high as 60,000
inute.
e four-sequence counter illustrated
is one of a complete line of prede-
ned counters available for one or
sequences. Each channel may be
for any number from 0 to 9999.
Switching through the four channels is automatic at the end of the count.

LOG LINEAR CONVERTER

Pickard & Burns, Inc., 240 Highland Avenue, Needham, Mass., has announced the availability of the Model 86 log linear converter. This unit produces a true logarithmic relationship between



any 50-kc. output or i.f. and the Model 86 meter reading, thus providing the user with means of recording up to 100 db on conventional linear recorders. Any portion of this 100-db range may be quickly expanded by push-button selection to give a full scale reading of 20, 40, 60, 80 or 100 db. Because of the logarithmic relationship, it is possible to read and record voltage changes of 100,000 to 1 without decading.

REMOTE CONTROL SYSTEM

The Hammarlund Manufacturing Company, Inc., 460 West 34th Street, New York 1, N. Y., has introduced a control system for unattended broadcast transmitters which meets the recently announced FCC regulation concerning such equipment. It is built on a high degree of flexibility and designed on building block principles, with *Hammarlund* control and supervisory unitized components.

Basic features of the system are: (1) only a single a.f. telephone circuit is required—v.h.f. or microwave may be used, but no d.c. circuit is needed; (2) full control of up to nine separate circuits is provided, as well as (3) remote telemetering of nine separate electrical quantities; (4) up to four emergency alarm indications are included, and (5) fail-safe operations are assured at all times.

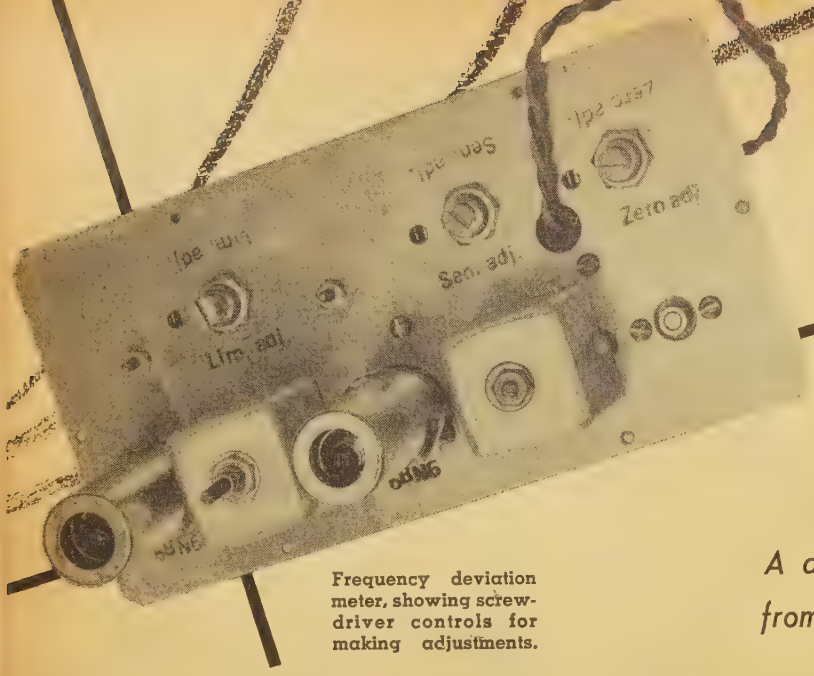
PHOTO CREDITS

PAGE	CREDIT
5, 6, 7, 14, 15, 32	National Bureau of Standards
9, 10	Central Electronics, Inc.
13	Bendix Radio

ERRATUM

In the circuit diagram of Fig. 2, p. 16, of the August issue ("Remote Temperature Measurement"), switch S_1 should be connected to the bottom end of the 100,000-ohm resistor instead of to the top end.

FREQUENCY — DEVIATION METER



Frequency deviation meter, showing screwdriver controls for making adjustments.

A device which indicates deviations of a sig from some reference frequency to better than 0.5

By **NORRIS HEKIMIAN**

National Bureau of Standards

TO PROVIDE more reliable and sensitive receiving and recording instruments for communications signals, the National Bureau of Standards has for some time carried on a continuous program of research and development in this field. The most recent product of the program is a comparatively simple frequency deviation meter developed at the NBS Central Radio Propagation Laboratory. This instrument indicates the deviations of a signal from a reference frequency to better than 0.5%.

As is true of most frequency deviation meters, the circuit of the NBS instrument consists of a limiter-discriminator arrangement and provision for driving an indicating device from the discriminator output. Normally, the arrangement includes two stages of limiting, one of discrimination, and a driving stage. However, by employing the new 6BN6 gated-beam tubes, it has been possible to reduce circuit complexity and to hold the tube complement to two in number. Advantage is taken of the input-output characteristic of the 6BN6 tube—which rises sharply to an equilibrium level, as in a step function—to obtain the second stage of limiting combined with quadrature-grid discrimination. The indicating device—a 150-0-150 microammeter—is driven through a d.c. bridge circuit by the current resulting from an unbalanced condition in the plate circuit of the discriminator.

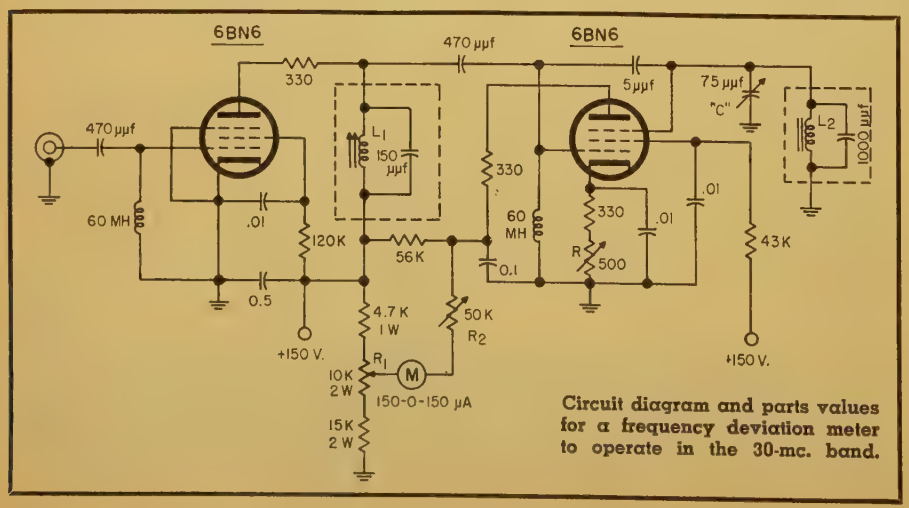
To avoid plate-current cutoff by self-bias, which is possible with gated-beam tubes, the circuit employs 60-mhy. chokes in the signal grid returns of the 6BN6 tubes. Low-value resistors are placed in the plate leads to help dampen the plate surges and to aid in obtaining a flat limiter characteristic.

The d.c. bridge resistors in the indicator circuit are of adequate wattage and sufficiently well ventilated to avoid changes in resistance from overheating. The tank coil in the plate circuit of the first stage is set to resonate at the center or reference frequency and has a Q of about 60 when adjusted on a m external to the circuit. The quadrat grid tank coil also resonates near center frequency and has a Q of when measured out of the circuit.

The NBS circuit has two inhe disadvantages: (1) Because the rent flow in the grid of the first 6 is limited, the input impedance of meter varies with the level of the i signal and has a minimum valu about 10,000 ohms. This relati large minimum is generally accept but a low-output impedance driv such as a cathode follower—may used when necessary as a buffer bet the signal source and the devia meter. (2) Like many other discr nators, the NBS unit shows consid ble interaction between discrimin adjustments. This often require tedious and prolonged initial alig procedure; however, the operation n be performed only once when meter is to be used at a fixed freque

Calibrations may be performe several ways, depending on the eq ment that is available. When a calibrated signal generator is use is necessary to calibrate only the put indicating meter directly ag the input frequency of the signal erator. The input to the devia meter should be set to at least 2.0 during the calibration.

One of the NBS frequency devia meters was used during a 1600- continuous life test to determine difference between the local and s oscillators in two 30-mc. receivers the conclusion of the examination deviation meter showed a chang less than 200 cycles, which was ably due to changes in the cr oscillators of the receivers. No ad ment to the deviation meter was n sary after the initial calibration.



Circuit diagram and parts values for a frequency deviation meter to operate in the 30-mc. band.

utperform on ALL Channels!

n that is greater by far than that offered by best of the collinears, conicals and multi-nent Yagis, is now offered by famous TRIO G-ZAG antennas!

sensational new TRIO development — a y re-entrant type impedance matching net-k — makes possible this tremendous im-vement by providing an almost perfect edance match to the line on every channel!

ike isolation filters, the ZIG-ZAG re-ant network has NO insertion loss!

ingle feed-line is used, even when stacking all-channel operation!

Extensive tests were made in all sections of the country, in every conceivable type of terrain. Results prove that the ZZ12L, ZZ16H combination, with their associated re-entrant networks, provides the finest all VHF channel, single lead-in operation yet obtained.

Current shipments of TRIO ZIG-ZAG antennas include the complete network.

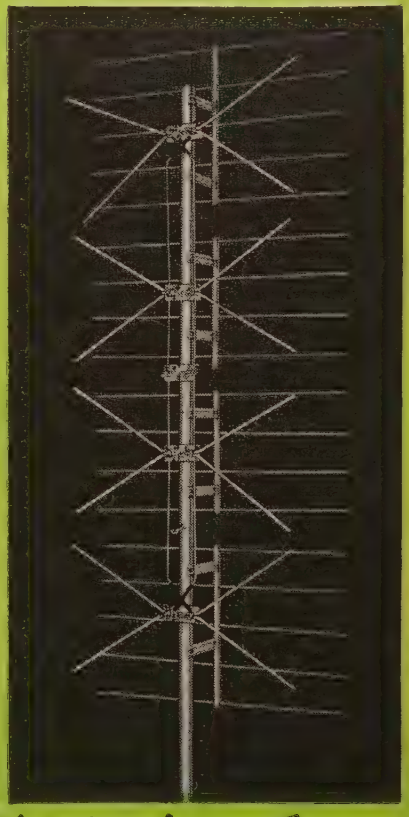
For channels 2 thru 6 or channels 7 thru 13 separately, or combined for channels 2 thru 13, TRIO ZIG-ZAG antennas are the hottest ever designed.

New descriptive literature available.

HIGH GAIN TRIO UHF ANTENNAS

UBT BOW-TIE SERIES

(4-stack, in actual tests, bests all other types)



popular TRIO 4-stack bow-tie, ctual field tests, outperformed all r types because it takes advan-e of the fact that UHF signals are posed of closely-spaced layers different signal strength. Because ts vertical height, the TRIO 4-k taps one or more of these vary-high density layers at all times — rs consistent high gain day in day out.

O bow-ties offer high forward without sacrificing excellent t-to-back ratio and good line match. Adoption of reflectors using individual horizontal elements elimi-nates vertically polarized noise pick-up so often encountered with grid, mesh and solid type reflectors.

TRIO bow-ties are also available in 2-stack and single stack models. The 4-stack and two stack come assem-bled on 4 foot and 3 foot aluminum masts respectively, with phasing har-ness installed. The single bay model is furnished assembled on a 2 foot aluminum mast.

TRIO Manufacturing Co.

GRIGGSVILLE, ILLINOIS

Within the INDUSTRY

COMMANDER R. C. SERGEANT, USNR, is the new technical division officer of the Navy's Electronic Supply Office, Great Lakes, Illinois. His work will include technical and engineering research relating to procurement, inventory control, and distribution of electronic control. He will also serve as liaison officer between the Navy and the electronics industry.

The Electronic Supply Office is the control point of the entire electronic supply system of the U. S. Navy.

Before entering the Naval service in 1940 he was employed by the *Mackay Radio and Telegraph Company* as radio supervisor of the San Francisco office.

* * *

KARL W. JENSEN, vice-president of *Jensen Industries, Inc.,* Chicago, has been elected chairman of the Association of Electronic Parts & Equipment Manufacturers, trade association of 120 midwest firms.

Theodore Rossman, general manager of *Pentron Corporation* was elected vice-chairman, the position formerly held by Mr. Jensen. Mr. Jensen succeeds Francis F. Florsheim as chairman.

Helen Staniland Quam, distributor sales manager of *Quam-Nichols Co.,* was re-elected treasurer of the association for her sixteenth term. Kenneth C. Prince was renamed executive secretary.

* * *

THOMAS A. EDISON, INCORPORATED has purchased **MEASUREMENTS CORPORATION** of Boonton, N. J., and will operate the company as a wholly-owned subsidiary. No basic change in policies or personnel is anticipated . . . **LA POINTE ELECTRONICS INC.** of Rockville, Conn., has purchased **CIRCUITRON, INC.,** manufacturers of printed circuits.

* * *

RTMA has announced a change in the Association's name to the Radio-Electronics-Television Manufacturers Association (RETMA) and the approval of a reorganization plan which will expand the board of directors and provide larger representation for new segments of the industry, especially in the advanced electronics field.

Under provisions of the by-law amendments and in accordance with the action taken by the board of directors in Chicago, two committees of the board were established. They are the radio-television industry committee and the electronics industry committee. Each director will be asked t select one of the two committees a representing his major interest an will be permitted to designate an a ternate to serve on the second com mitee providing his company is er gaged in the manufacture and sale o products or services within the spher of that committee.

The Association also announced th establishment of a West Coast offic in Los Angeles. Joseph J. Peterso will head the new office.

* * *

WILLYS MOTORS, INC. has announce that its electronics division is entet ing the television transmitter field t help speed opening of the some-200 authorized u.h.f. TV stations.

The company is planning to offer "TV package" consisting of a 10 watt transmitter (operating from 4 to 900 mc.), camera, projector, co sole, panel, etc. to licensees in are of 50,000 population or less.

The company is also working wi the National Association of Educ tional Broadcasters to develop a tran mitter that meets the special requir ments of educational TV systems.

* * *

BERNE FISHER has been named direct of engineering for *Standard Coil Pro ucts Co. Inc.*

Mr. Fisher, who holds a number of mechanical and electrical patents relating largely to television equipment, has been associated with *General Instrument Corporation* for the past eighte years, most recently as chief engine and production manager.

The company makes televisi tuners and through its subsidia *Kollsman Instrument Corporation,* a major producer of aviation instr ments and systems.

* * *

WINCHARGER CORPORATION of Sio City, Iowa, will build a new manuf turing plant on high ground away fr the danger of flood waters that caus considerable damage to the plant June. The new plant will have a flo space of 300,000 square feet, more th double the space occupied by the pr ent factory . . . **RESDEL ENGINEERI CORPORATION** is building an additi al plant of 21,000 square feet at 3 San Fernando Road, Glendale, Calif nia. The firm is presently located 2351 Riverside Drive, Los Angeles California . . . **MOSLEY ELECTRONI INC.** of St. Louis has moved all exe

TRAIN *FASTER* — TRAIN *BETTER* — TRAIN *EASIER*
IN 10 MONTHS — OR LESS — FOR
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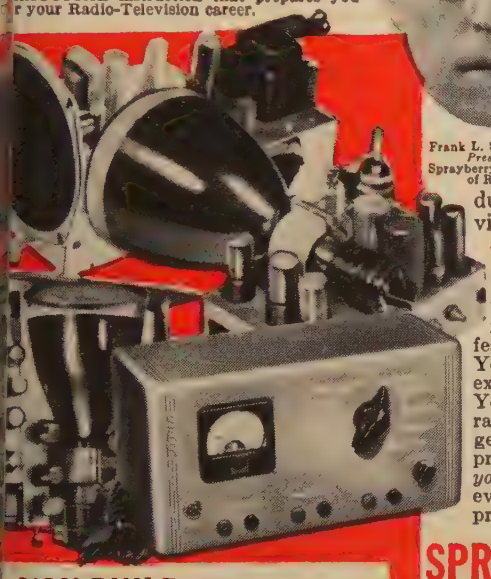
Our 21st Year Training Men for Greater Incomes and Security in Radio-Television

I SEND YOU 8 BIG KITS

Radio Television parts and equipment. Much of your training will be actual construction and experimentation . . . the kind of truly PRACTICAL instruction that prepares you for your Radio-Television career.



Frank L. Sprayberry
President
Sprayberry Academy of Radio

YOU BUILD the Television set and the powerful superhet radio receiver shown above. IN ADDITION to the other test units shown here (many are not shown because of lack of space). All equipment I send you is YOURS TO KEEP.

NEW! NO OBLIGATION PLAN

You Have No Monthly Payment Contract to Sign
Pay For Your Training as You Earn and Learn

You can get into Radio-Television, today's fastest growing big money opportunity field, in *months* instead of years! My completely new "package unit" training plan prepares you in as little as 10 months or even less! *No monthly payment contract to sign—thus NO RISK to you!* This is America's finest, most complete, practical training—gets you ready to handle any practical job in the booming Radio-Television industry. Start your own profitable Radio-Television shop . . . or accept a good paying job. I have trained hundreds of successful Radio-Television technicians during the past 21 years—and stand ready to train you, even if you have no previous experience! Mail coupon and get all the facts—FREE!

Valuable Equipment Included With Training

The new Sprayberry "package" plan includes many big kits of genuine, professional Radio-Television equipment. You perform over 300 demonstrations, experiments and construction projects. You build a powerful 6-tube 2-band radio set, multi-range test meter, signal generator, signal tracer, many other projects. All equipment and lessons are *yours to keep* . . . you have practically everything you need to set up your own profitable Radio-Television service shop.

Earn Extra Money While You Learn!

All your 10 months of training is IN YOUR HOME in spare hours. Keep on with your present job and income while learning. With each training "package" unit, you receive extra plans and "Business Builder" ideas for spare time Radio-Television jobs. New television stations everywhere, open vast new opportunities for trained Radio-Television Technicians—and those in training. If you expect to be in the armed forces later, there is no better preparation than practical Sprayberry Radio-Television training.

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FREE TO YOU 3 BIG RADIO-TELEVISION BOOKS

I want you to have ALL the facts about my new 10-MONTH Radio-Television Training—without cost! Rush coupon for my three big Radio-Television books: "How to Make Money in Radio-Television." PLUS my new illustrated Television Bulletin PLUS an actual sample Sprayberry Lesson—ALL FREE. No obligation and no salesman will call. Mail coupon NOW!

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Please rush to me all information on your 10-MONTH Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me. Be sure to include 3 books FREE.

Name..... Age.....

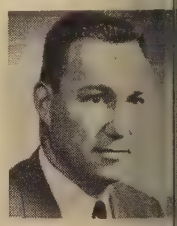
Address.....

City..... Zone..... State.....

tive and general offices into new quar ters at 8622 St. Charles Rock Road, S Louis 14, Missouri . . . **CHICAGO TELE PHONE SUPPLY CORPORATION** has com pleted and equipped a new, moder building which adds 64,182 square fee to its manufacturing and office spac in Elkhart, Indiana . . . **SKYLINE MF CO.** has increased its plant area 1458 E. 17th St. in Cleveland, Ohio, b 25 per-cent. The new space will b used for the increased production u.h.f.-v.h.f. antennas . . . **DESIGNER FOR INDUSTRY, INC.** has expanded i engineering and research facilities a newly-renovated building at 3107 D troit Avenue, Cleveland. The new plan adds 8000 square feet to the company development and manufacturing are . . . **AUDIO DEVICES, INC.** has expand ed its plant and factilities in Gle brook, Conn., to permit stepping u production of recording tape by least 50 per-cent . . . **TELETRONIC LABORATORY, INC.** has recently com pleted the construction of a new eng neering building located adjacent to i manufacturing plant on Kinkel Stree Westbury, L. I., New York . . . **TH HERLEC CORPORATION,** midweste manufacturing subsidiary of **SPRAGU ELECTRIC COMPANY** has moved all its operations to its new plant at Gra ton, Wisconsin. The new facility is l cated in a rural area about 25 mil from the company's former location the heart of downtown Milwaukee . **THE HALLICRAFTERS COMPANY** h begun construction on a new $400,0 plant in Toronto, Ontario. It is e pected to be in operation by Oct ber.

* * *

ROSCOE A. AMMON, for twelve yea general manager and chief engine of the *Marion Electrical Instrument Company* of Manchester, N. H., has now become president and principal stockholder of the corporation.



He succeeds William F. McElroy who will retire from active manag ment but continue to serve as a dire tor and in an advisory capacity. M Ammon assumes the duties of pre dent and treasurer while Herbe Schachat will serve as vice-preside in charge of operations.

The company makes a complete li of electrical indicating instruments.

* * *

EDWIN E. FREED has been named man ger of operations of *General Instr ment Corporation's* headquarters pla in Elizabeth, N. J. . . . **ROY E. NE SON,** veteran of *RCA* engineering a sales activities, has been promoted the newly-created post of manager semi-conductor equipment sales for t Tube Department of the *RCA Vict Division* . . . **DR. WILBUR A. LAZI** has been named vice-president a technical director in charge of t *Sprague Electric Company's* resear

(*Continued on page* 213)

TELEVISION SWEEP GENERATORS

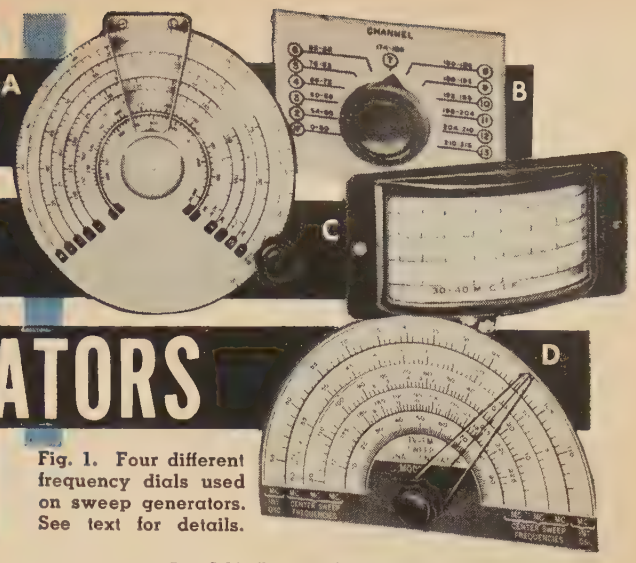


Fig. 1. Four different frequency dials used on sweep generators. See text for details.

By **MILTON S. KIVER**
Pres., Television Communications Institute

A survey of some commercially-available units, how they are used, and what they are able to do.

Triplett Model 3434-A.

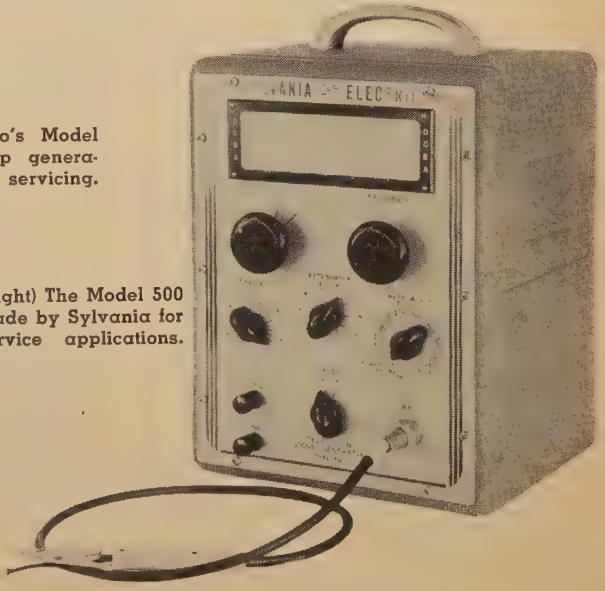
UNTIL the advent of television, comparatively few service shops boasted a sweep generator. Yet, today, the same instrument is considered one of the four basic instruments that every service shop must possess.

The reason for this change in status is not very hard to understand. An AM radio can be properly aligned using only an r.f. signal generator and a v.o.m. or v.t.v.m. A television receiver, on the other hand, has a bandpass of 3.2 to 4.0 megacycles in its i.f. stages and 6.0 mc. in its r.f. section. To attempt to align circuits covering this bandwidth with an r.f. generator would not only be time-consuming but, in most cases, almost impossible. Each time a change was made, a new alignment run would be required and, while this may be feasible for the hobbyist, it would be economic suicide for the service technician.

A sweep generator (also called FM generator and TV alignment generator) differs from the more familiar AM generator in that it produces a range of frequencies for each dial setting rather than a single frequency. All the frequencies within this range do not appear at the same time; rather, they appear in sequence. Thus, suppose we have a sweep generator that is set at a frequency of 24 mc. and the sweep width control is adjusted for a 4 mc.

Jackson's Model TVG-2 generator.

(Left) Philco's Model 7008 sweep generator for TV servicing.



(Right) The Model 500 made by Sylvania for service applications.

sweep. This means that the output of the generator will sweep from 22 mc. to 26 mc. or over the specified range of 4 mc. This sweeping signal would then be applied to the input of, say, a video i.f. system. Here, each portion of the signal would be treated according to the characteristics of that system. It might be, for example, that the 22 mc. portion of the signal would receive more amplification than the 26 mc. portion, in which case the 22 mc. voltage would be stronger at the output of the system than the 26 mc. signal. This variation in amplitude of the various signals will be detected at the video detector (which is an AM detector) and then presented on the screen of an oscilloscope.

Now, although the sweep generator is an important service tool, it seems to be one of the most difficult to operate. Part of the difficulty stems from the fact that it must be used in conjunction with an oscilloscope which is, in itself, somewhat complex; and part of the trouble is undoubtedly du to the bewildering array of respons patterns that can be produced if th instrument is not properly set up.

Oscilloscopes and their operatio have already been covered in a prev ous issue of this magazine*. Henc here, we will turn our attention t the front panels of today's sweep ge erators in order to note what the contain and what each control doe

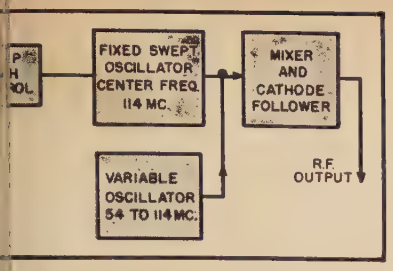
Sweep Generator Frequency Dia The main control is the frequenc dial. This tells you to what cent

* Oscilloscopes—The Electronic Eye of the Service Technician" by M. S. Kiver. January, 1953.

Table 1. Performance data on commercially-available TV sweep generators as received direct from the manufacturers.

Make and Model	Freq. Range	Blanking Control	Internal Marker Gen.	Sweep Phase Reversal Sw.	Price	Remarks
Eico Model 360	500 kc.-228 mc.	No	See Note 1	No	$34.95 (kit form)	External binding post for cor nection of an external marke generator.
General Electric Model ST-4A	4-110 mc. 170-220 mc.	Yes	No	Yes	$395.00	Strong, flat output, low lea age, and good attenuation Wide range of phase contro
Hickok Model 610A	0-115 mc. 150-230 mc.	No	Variable from 19-48 mc.	No	$219.00	Special FM scale for swee width control. Crystal osc. an ext. crystal jack. Absorption type marker plus regular pip type marker.
Jackson Model TVG-2	2-108 mc. 174-216 mc.	Yes	Variable from 4-216 mc.	Yes	$245.00	Separate crystal osc. and ex crystal socket. Provision f video mod. of marker signa Beat detector for signal cal bration. 400-cycle AM mod lation of marker signal. Tw or three marker pips can b used simultaneously.
Philco Model 7008	4-120 mc. 145-260 mc.	Yes	Variable from 3.2-250 mc.	No	$466.00	Contains separate scope wit 3" screen. 400-cycle mod. marker gen. Scope may b used externally. Internal cry tal calibrator.
Precision Model E-400	2-480 mc.	Yes	See Note 1	Yes See Note 2	$133.03	Special FM scale for swe width control. Internal cry tal osc. with provision for ext. crystals. Ext. AM mod. r.f. signal possible, if desire Panel terminal for marker si nal injection.
RCA Model WR-59C	0-50 mc. continuous. Channels 2-13 preset	Yes	No	No	$274.50	Strong, flat output, low lea age, wide attenuation ran linear sweep, terminated ou put cables.
Simpson Model 479	2-120 mc. 140-260 mc.	Yes	Variable from 3.3-250 mc.	No	$325.00	400-cycle AM modulation marker gen. Internal crys osc. for calibration, low sign leakage. Harmonics of A FM generators said to be us ful in u.h.f. TV range.
Simpson Model 480	Same as Model 479 with addition of built-in 3" scope.				$475.00	
Sylvania Model 500	2-230 mc.	No	No	No	$139.50	Narrow- and wide-band swee Good attenuator contro Good output.
Triplett Model 3434-A	0-240 mc.	No	Variable from 3.5-4.9 mc. 19.5-48.6 mc. Harmonics to 241 mc.	No	$199.50	Internal crystal osc. with e crystal socket. Bar genera for vert. linearity adjustme Provides absorption and p type markers. 600-cycle mo ulation of marker generat

Note 1: These generators have an internal crystal oscillator. By inserting the proper crystals via a front panel socke various fixed marker frequencies can be obtained.
Note 2: The sweep width control has a center zero position that permits the operator to reverse the horizontal directio of the response curve.



fl. Simplified block diagram of sweep rator shown in Fig. 1D. This arrange- provides output frequencies from 500 228 mc. without using bandswitch.

ency the instrument is set. Thus, dial is positioned at 26 mc., then tput sweep frequencies will vary ual amount above and below this . Just how much variation will depends upon the setting of an- control, known as the sweep control.

eral representative front dials hown in Fig. 1. The dial shown g. 1D has all of its ranges ex- and the desired frequency is hed by setting the hairline over roper figure. The frequency range able from this sweep generator ds roughly from 500 kc. to 228 The bottom scale is a reference marked from 0 to 100 linearly. ext three scales, marked "center frequencies," are calibrated 0-60, 0-120, and 168-228 mc. The most scale is an internal oscil- having a range of 54 to 114 mc. w, the rather surprising thing t this particular instrument is all output ranges are available ut bandswitching. This is ved by the arrangement shown g. 2. An oscillator with a fixed ency of 114 mc. is frequency lated to a maximum sweep width mc., sweeping this fixed oscil- back and forth from 99 to 129 The amount of frequency modu- is controlled by the sweep width ol setting.

e output of the fixed sweep oscil- is mixed with that of a variable ator. This second oscillator can ned to any frequency between 54 114 mc. by rotating the main g dial pointer. The resulting between these two oscillators fixed and frequency modulated the other variable) provide the

frequency ranges of the instrument.

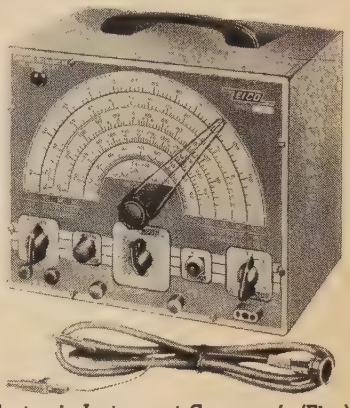
For example, the "difference" frequencies between the 114 mc. fixed oscillator and the 54-114 mc. variable oscillator provide the frequency range of 60 to 0 mc. The "sum" frequencies of the two oscillators provide the range of 168 to 228 mc. The second harmonic of the "difference" frequencies gives the range 120 to 0 mc.

In the dial shown in Fig. 1A the hairline indicator is kept stationary and the dial is rotated. The various frequency ranges are selected here by means of a band selector switch and, in general, this is typical of most sweep generators using continuous tuning.

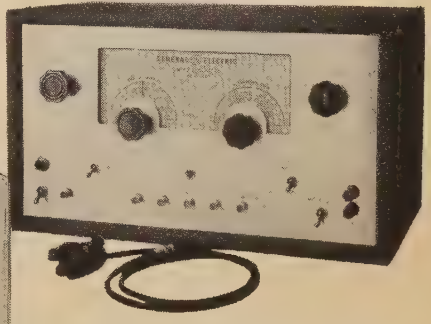
The illustration of a third dial, Fig. 1B, represents still another approach to this problem. Here, the main tuning dial is a thirteen-position selector switch. The first position is marked "0-50" (mc.) and in this position frequencies up to 50 mc. may be obtained from the instrument. Just precisely which frequencies is determined by another control which has markings on it of 5, 15, 25, 35, and 45. This second control thus enables the user to set the frequency at any point within the 0 to 50 mc. range. The five numbers are positioned at appropriate points around the rotational range of the second control in order to indicate approximately where the various frequencies may be obtained. In actual practice the service technician would rotate the second control until a response pattern appeared on the scope screen.

As the reader undoubtedly knows,

Precision Apparatus Co.'s Model E-400 television service sweep generator.



Electronic Instrument Company's (Eico) Model 360 unit available in kit form.

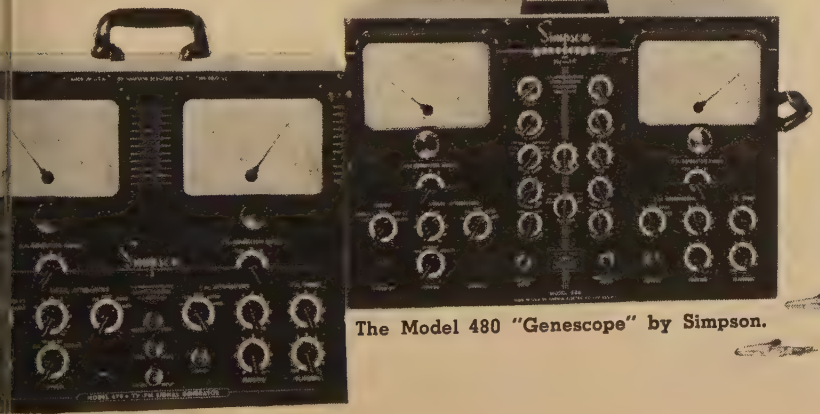


The Model ST-4A by General Electric.

Hickok's Model 610A generator unit.

Radio Corporation of America's WR-59C.

son's Model 479 sweep generator.



The Model 480 "Genescope" by Simpson.

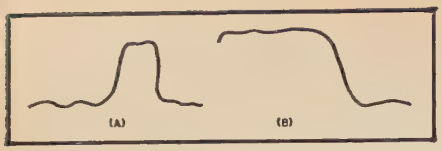


Fig. 3. When the sweep is too wide, the pattern will tend to crowd together (A). When too little sweep is used, the full pattern may not be obtained as shown in curve (B).

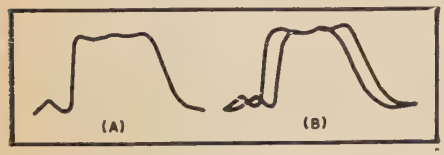


Fig. 4. (A) Desired single pattern response curve. (B) Double trace pattern obtained before phase control adjustment.

the 0-50 mc. range is employed for aligning the i.f. systems of television receivers. Then, for the r.f. frequencies of the twelve v.h.f. channels, the selector switch is set to the appropriate position. This particular arrangement possesses the very desirable advantage of simplicity. It can suffer if the circuit design is not sufficiently stable to maintain the various frequencies within the range specified at each position. Should this happen (and it may occasionally), then a series of internal adjustments are provided which the technician himself can perform.

The final dial illustration, Fig. 1C, employs a drum arrangement in which the frequency ranges are marked off around the outer surface of the drum. To choose the desired frequency, the drum is rotated until the appropriate figure is positioned directly underneath a fixed hairline indicator.

Sweep width control: Associated with the main tuning dial, and used in conjunction with it, is the sweep width control. The setting of this control determines the extent of the signal sweep about the frequency chosen by the main dial. On some instruments, the control has a scale marked off from 0 to 10, or 15, or 30 depending upon how great a sweep can be obtained with the instrument. On other generators, the scale is omitted. Actually, the markings on a scale, when used, are approximate anyway and most technicians seldom pay much attention to them. They simply adjust the control until the full pattern is observed on the screen. Too much sweep will tend to narrow or crowd the pattern together (Fig. 3A); too little sweep will not bring the full pattern to the scope screen (Fig. 3B). The former, of course, is more desirable than the latter, but with a little practice it is not difficult to obtain the proper amount of sweep.

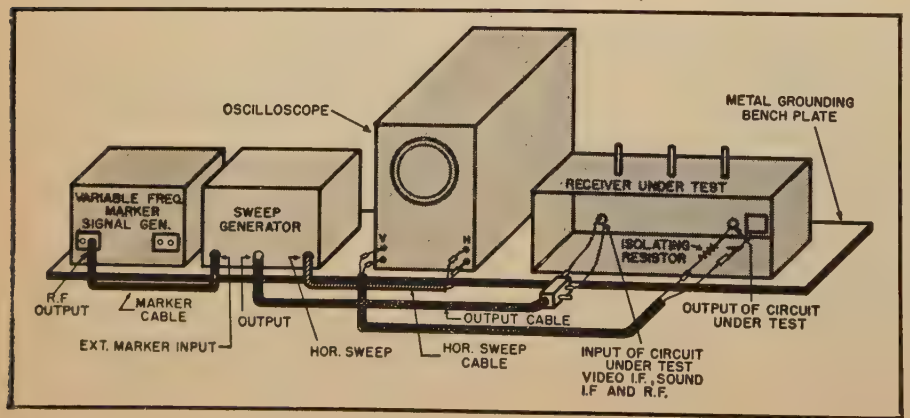
Incidentally, sweep values, when given, refer to the total width and not that which is swept out on either side of the center frequency. For example, setting the sweep width control to 10 mc. and using a center dial frequency of 24 mc. means that the output frequency will vary from 19 mc. (24 — 5) to 29 mc. (24 + 5).

Many television sweep generators are also capable of covering the FM r.f. range (88 to 108 mc.) and the FM i.f. range (10.7 mc.). Where this is true, a second scale is frequently inserted around the sweep width control knob, extending from 0 to 1 or 1.5 mc. A 1-megacycle sweep is adequate for the alignment of FM circuits and as a convenience to the user, this special range permits him to set the sweep control more easily. A special switch is usually available and when the generator is to be used on FM, the switch is flipped over and then the sweep width control deals with its FM scale (0 - 1 or 1.5 mc.) rather than the TV scale (0 - 10, 15, or 30 mc.).

It is, of course, perfectly possible to employ the same sweep width scale for both FM and TV receivers. The only precaution necessary is to see that the control is set to approximately 1 megacycle for FM. Providing a separate control variation for FM is a convenience; it is not, however, absolutely necessary.

It is interesting to note that when the sweep width control is set at zero, the signal output of the generator is simply a single r.f. frequency determined by the setting of the main dial. Thus, although the technician seldom uses his sweep generator as an r.f. generator, it does possess this facility. One manufacturer even goes so far as to provide input terminals to which an audio signal can be applied in order that the generator output may be amplitude modulated.

Fig. 5. Service bench setup showing how sweep generator is connected to receiver.



Possibly one reason why service technicians seldom use their sweep generators for single signal applications is because less emphasis is placed on dial marking accuracy in these units. Sweep generators are designed primarily to produce a response pattern on a scope screen and an accurate r.f. generator is then brought in for the purpose of supplying suitable identifying markers. As long as the sweep generator produces the desired response trace, its obligation is fulfilled and no one particularly cares whether or not the dial markings are accurate. However, when employed as an r.f. generator, frequency accuracy does become important and now close attention is paid to the dial setting. There is, of course, no reason why the dial markings of a sweep generator should not be correct and many are. But as a whole, they are less reliable than comparable AM generators.

The strength or amplitude of the output signal of the sweep generator is controlled by an r.f. output (or r.f. attenuator) potentiometer. Sometimes this is the only control; at other times it is accompanied by a coarse selector switch attentuator possessing steps of X1, X10, X100, X1000, and X10,000. Whatever the arrangement, the technician will find that the controls are usually kept much closer to their maximum positions than they are to their minimum positions.

Phase control: The phase control which is found on the front panel of every sweep signal generator, has a function which is probably least understood and has, consequently, caused more trouble than any other control on the instrument.

First off, let it be stated that until a response pattern of the circuit under test is obtained on the scope screen no attention is paid to the phase control. Once the pattern is developed, however, the phase control is rotated until a single trace, or as close as the technician can come to a single trace is obtained. Thus, suppose the circuit receiving the sweep signal is the video i.f. system of a television receiver. Then its normal response pattern may be that shown in Fig. 4A. However, when the sweep generator and oscilloscope are first hooked up to the TV chassis, chances are the initial response pattern developed on the screen would be as shown in Fig. 4B. By rotating the phase control, the two patterns can be made to blend, giving the trace shown in Fig. 4A.

The phase control, then, is a corrective control, designed to bring the beam deflection of the scope in step with the frequency sweeping voltage obtained from the generator.

This leads us directly to another terminal on the front panel of the sweep generator. This terminal is known by such names as "Horizontal Sweep", "60-Cycles", "Phase 60 ~", "Horizontal CRO Input", "Scope", or "Sync", provides a sinusoidal 60-cycle voltage which is connected to the h

(*Continued on page* 200)

HE NOVICE STATION RECEIVER

By

ARRY TROMBLY, WØDCB

and

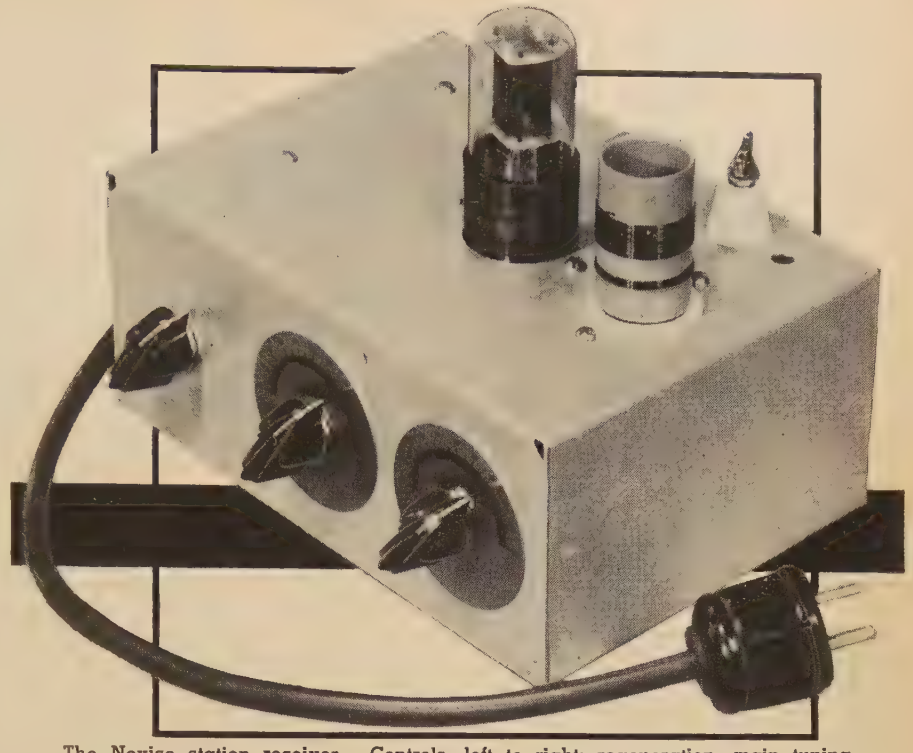
RT A. HATHAWAY, WØGTK

Walter Ashe Radio Company

first article of this series de- ibed a transmitter and power pply. Including the receiver to scribed here, these three units built for less than $50.00. This er, although quite simple and circuits almost forgotten in to- amateur receivers, exceeds ex- ions and gives an excellent ht of itself in the crowded e bands.

receiver uses a 6SN7 tube, one h of which acts as a regenera- etector, and the second section transformer-coupled stage of amplification. One of the rea- or the good performance of this er is the use of regulated plate e, which is furnished by the VR n the power supply described in 1. Crystal-controlled signals the way they should, rather he way they did in most regen- e receivers of twenty years ago it was hard to tell whether you listening to crystal control or self-excited oscillator.

the parts of this unit are ted on a 5"x7"x3" chassis. Their on can be seen from a study of notographs and there is nothing al about the placement of these Since it was desired to keep ning condensers inside the chas- was not feasible to use a ver- dial. However, the use of a coil and a low-capacity vari- condenser for bandspread tuning



The Novice station receiver. Controls, left to right: regeneration, main tuning, bandspread. Hole near antenna insulator is for adjusting antenna trimmer. Cable plug fits socket on power supply described last month. 80-meter coil is in place.

Part 2: The receiver. The set uses one tube in a "two-tube" circuit. Performance is very high and construction simple. The transmitter and power supply were described last month.

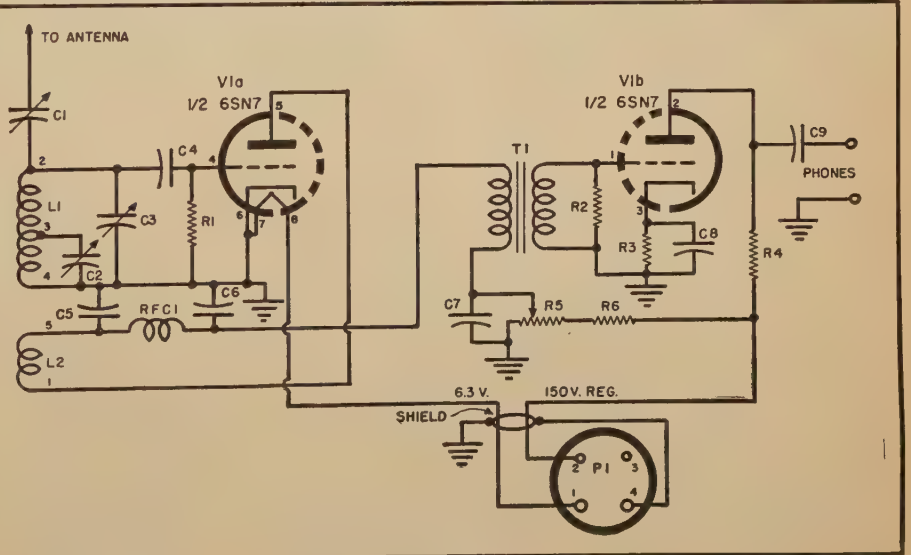
permitted us to give almost 100 dial divisions of bandspread to the 50 kc. 80-meter Novice assignment and also to the 25 kc. 40-meter Novice band. This is more rotation of the tuning control per kilocycle covered than is offered by many vernier dial arrangements.

To some builders a tapped coil may present something of a problem but there is a way of doing it which

(*Continued on page* 122)

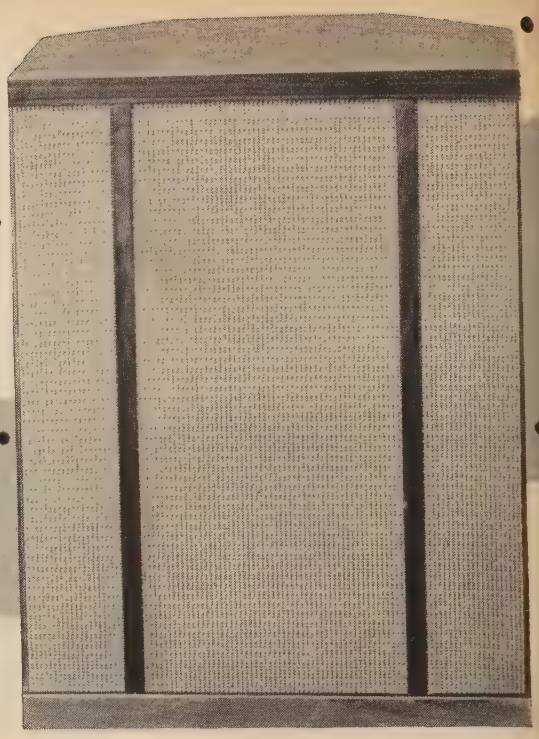
Schematic of the Novice station receiver. Numbers at coil connections refer to pins on coil form, looking at bottom of form. C_2 is the bandspread condenser, C_3 is for main tuning. C_1 compensates for "dead spots" due to antenna resonances.

-1.5 megohm, ½ w. res.
-150,000 ohm, ½ w. res.
-1500 ohm, ½ w. res.
-10,000 ohm, 1 w. res.
-50,000 ohm pot.
-33,000 ohm, 1 w. res.
-3-35 μμfd. trimmer cond.
-15 μμfd. var. cond.
-140 μμfd. var. cond.
-100 μμfd. mica cond.
C_6—500 μμfd. mica cond.
-12 μfd., 150 v. elec. cond.
-10 μfd., 25 v. elec. cond.
-.01 μfd., 600 v. cond.
T_1—2.5 mhy. r.f. choke
-80 m.—21½ t. tapped at 10¾ t. from bottom (ground) end. 40 m.—9½ t. tapped at 2¾ t. from bottom (ground) end
-80 m.—3¾ t. ("tickler" coil)
40 m.—2¾ t. ("tickler" coil)
coils closewound with #26 en. wire on 1" diameter, 5-prong coil forms. "Tickler" coils wound at gnd. end of L_1, ¼" below L_1. All coils wound in same direction.
-4-prong cable plug
-Audio interstage trans., 3:1 ratio
-6SN7 tube



THE KLIPSCH REBEL IV A BACK-LOADING FOLDED CORNER HORN

By **FREDERICK I. KANTOR**
G & H Wood Products Co. (Cabinart)



Front view of Klipsch-licensed enclosure being manufactured by the G & H firm.

Details of an enclosure whose compact design makes it idea for small apartments while providing big-cabinet response

THE speaker system to be described is a new version of the corner horn back-loading type. This general type has been developed independently by several workers, but this specific design stems from the *Klipsch* series of "Rebels," of which the IV is small enough for substantially any environment—even a monitoring studio—but with big enough performance for highly exacting requirements.

With the majority of loudspeakers suffering a loss of efficiency in the low-frequency region (from 100 cps down) a means of increasing radiation in this portion of the spectrum, without increasing distortion, is of significant interest.

At these low frequencies, the loudspeaker's cone action is essentially piston-like. That is, its function is to move a considerable amount of air. To do so, the cone is required to travel farther to generate the same acoustical power than it would be at a higher frequency. At its extreme limit of travel, nonlinearity must occur. At high levels the distortion caused at the bass end will simulate a square wave and give serious intermodulation effects to the middle and highs. Several means have been devised to eliminate this nonlinear effect and increase efficiency in the low-frequency ranges. Comparative evaluations of some of these types and an examination of the workings of the back-loaded folded horn will indicate why it is being demanded more and more for critical high-fidelity reproduction.

The present development entails a cavity and slot port, to form a resonant chamber, and a horn coupled to the slot. The slot is loaded by the horn; the proportioning of slot, cavity, and horn provide a base response below about 100 cps which corresponds in efficiency to the front-of-cone direct radiator response above 100 cycles. More complicated horn structures (except high-efficiency, full-range multiple horn systems) have been tried and discarded in favor of this simple and effective device. The function of this form of back-loading corner horn may be considered qualitatively in two different ways.

First, think of a bass reflex with a horn acting as a resistive load on the port. The resonances of the system are damped by useful radiation resistance, and the horn does not cost anything as it is formed by the already existing walls of the room at its corner.

Second, think of a horn which is essentially a high efficiency device—if a full horn were applied below 100 cycles, a boomy response would exist. But the cavity-port combination acts as an acoustic low-pass filter, the design of which can be such that the bass range response will correspond to the mid-range response.

In actual usage, the "Rebel IV's" performance is influenced by few restrictions. The cabinet must be placed flush with the walls of the corner, to maintain the horn flare. This is accomplished easily since the cabinet has no interfering sides and will clear any baseboard or molding. It is, of course, more desirable to mount the woofer in the lower position so that spatial distribution and high frequency absorption will not be influenced by walls, rugs, furniture, etc. The enclosure offers a means of mounting many and varied combinations, *i.e.,* one woofer or coaxial speaker, one woofer and tweeter, a three-way system, etc. This is accomplished by cutting two holes, and covering one with a backing board which is bolted over the additional hole. If you have a 12" speaker you want to mount in addition to the woofer, just rem this board and install a speaker in place. If it's a smaller speaker, tw er, or what have you, remove board, and cut out the opening to s There is space in the bottom for crossover system and leads brought to a barrier-type term board on the outside. The cabine constructed rigidly with ¾" plyw with a unique system of inher bracing to insure no cabinet r nances. This also provides quick stallation of components and re accessibility.

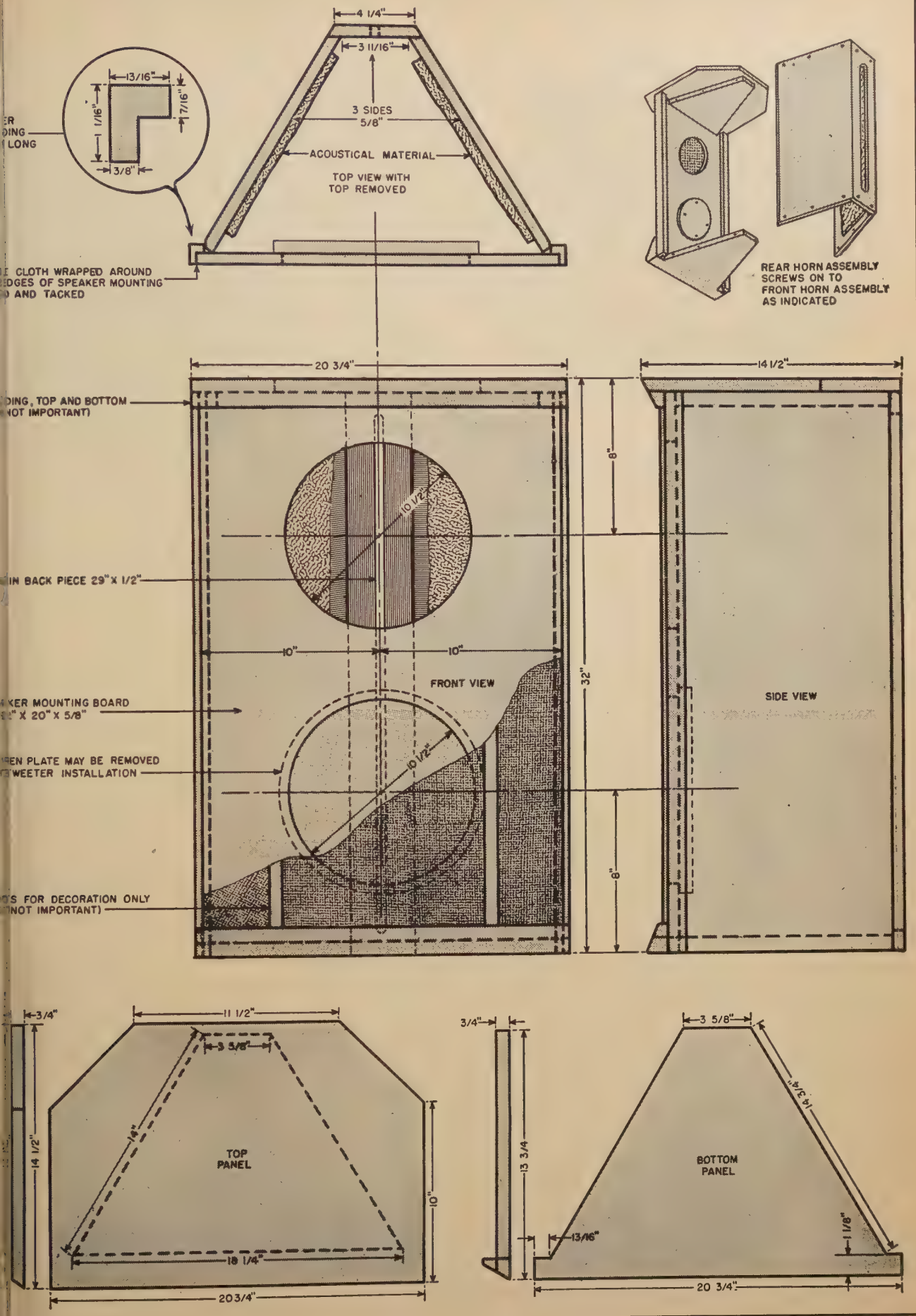
Tested in the home and sound dios throughout the country, *Klipsch* "Rebel IV" has been well ceived by a gratifying number of criminating audiophiles and m lovers. Its low frequency perfo ance has enhanced systems with as it should be, clean, no boomy sponses, no noticeable resonances. termodulation effects are redu and its small size and attractive pearance will fit and enhance any ing room environment.

The complete mechanical details this particular unit are included in line drawings on the opposite p All of the dimensions given are e and should be adhered to for 12-i speakers as well as the various c binations of speakers mentioned lier in the article.

The commercial version of this inet is also available in a size to h a 15-inch loudspeaker as well as in form for both the 12-inch and 15-i speakers.

—30—

Complete construction details on the G & H Wood Products Co.'s "Rebel IV," a Klipsch-licensed enclosure.



TV TUBE SUBSTITUTIONS

By
WALTER H. BUCHSBAUM
Television Consultant
RADIO & TELEVISION NEWS

Save this handy guide which lists the tubes most often found in TV receivers and their substitutes.

WHEN a defective tube cannot be quickly replaced from the service technician's stock, the local distributor happens to be out of this number, and the customer is anxious to get his set back, a substitution is often possible. Sometimes another tube type can be plugged into the same socket, adjustment of the circuit might be required, or it may even be necessary to rewire the socket or use an adapter. Whatever means are taken to substitute a different tube type, the customer should understand that the best performance will be obtained when the correct tube is used and that in most instances a substitute is just what the name implies—something to take the place of the correct tube.

Occasionally we hear of service technicians who make substitutions, even rewiring parts of the receiver, without informing the set owner. Usually the customer will find this out when he takes his set to another technician and, whether the rewi portion is really an improvement not, the customer will always distrustful and unhappy. Whene any circuit changes or tube substi tions are made, be sure to expl them to the set owner.

Tube replacements in the r.f., and horizontal sync sections usua require realignment or some readju ment of secondary controls. Wher slightly different tube type is us this readjustment will also be nec sary. In *many instances the use o different tube type is possible* would require a change in the cuit. The table of tube substituti given below does not include substitution where a different cir component is also needed or wh extensive rewiring is necessary. the substitutions shown can be m either by direct plug-in, rewiring socket pins only, or else by usin different socket.

Many of the tubes used in TV ceivers are electrically identical have different socket and bulb si For example, the 12AU7 is a 9 miniature tube and is electrically terchangeable with the 6SN7, an o base type. All that is needed to s stitute one for the other is an ada or else removing the old socket mounting a new one. This is o difficult because sockets are rivi to the chassis and in the proces

(*Continued on page* 183)

Table of TV tube substitutions. Some tubes have no practical substitute and are so listed.

TUBE	DIRECT SUBSTITUTE	CHANGE CONNECTION	CHANGE SOCKET
1B3			1X2, 7-pin
1V2			
1X2			1B3, octal
5U4	5T4	5X4 (plates 3, 5; fil. 7, 8)	5Z3, 4-prong
5V4	5U4, 5T4	5X4 (plates 3, 5; fil. 7, 8)	5Z3, 4-prong
5W4	5V4, 5Y3	5Y4 (plates 3, 5; fil. 7, 8)	
5Y3	5V4	5Y4 (plates 3, 5; fil. 7, 8)	
6AB4			
6AC7			6AH6, 7-pin
6AF4			
6AG5	6AK5, 6BC5	6CB6 (short 2 and 7)	
6AG7			6CL6, 9-pin
6AH4			6S4, 9-pin
6AH6			6AC7, octal
6AJ4			
6AK5	6BC5	6CB6 (short 2 and 7)	
6AL5			6H6, octal
6AM4			
6AN4			
6AQ5		6AR5 (short 1 and 7)	6V6, octal
6AQ8	6AV6		
6AR5	6AQ5		6K6, octal
6AS7			
6AT6	6AV6, 6AQ6		7C6, 7B6, loctal
6AU5	6AV5		
6AU6		6CB6 (interchange 2, 7)	
6AV5	6AU5		
6AV6	6AT6, 6AQ6		
6AX4	6U4		6V3, 9-pin (top cap)
6BA6	6BC5	6CB6 (interchange 2, 7)	
6BC5	6AG5, 6AK5		
6BE6			6SA7 octal; 7Q7 loctal
6BD6			6SK7 octal
6BF5			
6BG6	6CD6		
6BK7	6BQ7, 6BZ7		
6BL7			
6BN6			
6BQ6			
6BQ7	6BK7, 6BZ7		
6BY5			
6BZ7	6BK7, 6BQ7		
6C4			6J5 octal
6CB6		6AU6 (interchange 2, 7)	
6CD6	6BG6		
6CL6		12BY7* (plate 7, screen 8, sup. 3, 9)	6AG7 octal
6H6			6AL5, 7-pin
6J5			6C4, 7-pin
6J6			
6K6			7B5, loctal, 6AR5, 7-pin
6L6			
6N7			
6S4			6AH4, octal
6S8			6T8, 9-pin, 7X7 loctal
6SA7	6SB7Y		6BE6 7-pin
6SB7Y	6SA7		6BE6 7-pin
6SH7		6SJ7 (short 3, 5)	6AU6 7-pin
6SJ7	6SH7		6AU6, 6CB6, 7-pin
6SK7			6BD6 7-pin, 7A7 locta
6SL7			12AX7* 9-pin
6SN7			12AU7* 9-pin, 7N7 loct
6T4			
6T8			6S8 octal; 7X7 loctal
6U4	6AX4		6V3 9-pin (top cap)
6U8			
6V3			
6V6	6Y6, 6W6		7C5 loctal; 6AQ5 7-pin
6W4	6AX4, 6U4		6V3 9-pin (top cap)
6W6	6V6		
6X4			7Y4 loctal
6X8			
6Y6	6V6, 6L6		
7A5			
7A6			6H6 octal
7A7			6SK7 octal
7AD7			6AG7 octal; 6CL6 9-pi
7B5			6K6 octal, 6AR5, 7-pi
7B6	7C6		6AT6, 6AV6, 7-pin
7C5			6V6 octal
7C6		7B6 (short 4, 7)	6AT6, 6AV6, 7-pin
7F8			12AT7*, 9-pin
7N7			6SN7 octal, 12AU7* 9-p
7Q7			6BE6, 7-pin, 6SA7 octa
7X7			6T8 9-pin, 6S8 octal
7Y4			6X4 7-pin
12AT7	12AZ7		7F8* loctal
12AU7			6SN7* octal, 7N7* loct
12AV7	12AX7		6SL7* octal
12AX7	12AV7		6SL7* octal
12AY7			6SN7* octal, 7N7* loc
12AZ7	12AT7		
12BH7			6BL7*, 6SN7* octal
12BY7		6CL6* (plate 6, screen 3, 8, sup. 7)	
12BZ7			
25L6			
25Z5	25Z6		
25Z6	25Z5		
35L6			
35W4			35Y4 loctal
35Z3			35Z4, 35Z5 octal
35Z4	35Z5		35Z3 loctal
35Z5	35Z4		35Z3 loctal

*Note: Check whether 6.3 or 12.6 volt heater voltage is used.

Color TV

By **WILLIAM R. FEINGOLD**
Emerson Radio & Phonograph Corporation

An experimental single-tube color TV camera, ch larger than its black-and-white counterpart.

Part 1: Clarifying the color TV situation with some predictions on what to expect in color receivers.

October 11, 1950, the Federal mmunications Commission ap- oved the field sequential system larly known as the *CBS* system) official color TV standard for nited States. This system had nder development for approxi- 10 years, and gave a fairly table performance in compari- ith competitive methods which more or less newly conceived. It n unfortunate choice, however, he the field sequential color sys- equired a vertical field rate of er second (as opposed to the and white of 60) and a line rate 60 cycles-per-second (as against ack and white of 15,750) to elim- flicker, thereby making this sys- incompatible with black and transmission standards. Finally, the NPA terminated all color tivity on November 20, 1951 in nterest of national defense, the system, as used in aerial TV missions, died a natural death. trictly industrial television use, 3S system is still being employed sed circuit applications.

the meantime, the Radio-Elec- s-Television Manufacturers As- ion set up a committee to for- e an improved compatible color . The more than 200 engineers physicists of this National Tele- System Committee (NTSC) 91 leading companies in the tele- industry formulated and tested or TV signal which could fit into resent 6 mc. channel, and was atible with the black and white mission standards.

e NTSC does not own any equip- neither transmitters nor receivers, and is not interested in the detailed circuitry of either type of equipment. Its interest in equipment stops at the point where it has been established that the signal specifications *can* be met with readily available gear. The end goal is a set of signal specifications, proven and practical, that can be presented to the FCC for approval. That this goal has been met has been amply attested to by the fact that numerous organized field tests have been arranged by the NTSC and attended by some 15 different manufacturers with their color receivers. These receivers represent the varied outputs of the different engineers all working from the same signal specifications and all receivers are producing excellent pictures.

The NTSC Signal

Although a detailed treatment of this new color signal will be made in the second article of this series, a simplified treatment is in order.

From a welter of data pertaining to the physiological aspects of color vision and a mass of theoretical data regarding the character of the television signal itself, the following color signal has been formulated. To the present monochrome standards as they now exist an additional color signal specification has been added. The resultant effect is not unlike the conventional lithographic technique of printing in three colors plus black to add the detail. In our case, the present monochrome information carries the shades of black and white including all the fine detail, and the color information is added on a color subcarrier to fill in the large areas of color (Fig. 2).

Tests have shown that the eye cannot perceive fine color detail, hence, there is no need to burden the color circuits with wide-band information. The shaded area on Fig. 2 indicates that this color information in the lower sideband is restricted to a bandwidth of 1.3 mc. Note, too, that the upper sideband cannot extend this far since the limits of the channel restrict this area to approximately 0.4 mc. Although this unsymmetrical distribution of sideband energy is not a desirable situation, it has been possible to design the details of the system in such a manner that it causes no extra trouble.

Because the lower sideband of the color information falls well within the monochrome video channel it was necessary, in the interest of compatibility, that this color data be made invisible on a standard black and white receiver. This was done (within the limitations of the linearity of the system) by setting the color subcarrier at a frequency which is an odd multiple of half the line repetition rate. The actual frequency selected by the NTSC is 3.58 mc. This unique feature of adding narrow-band color information on a special color subcarrier to a

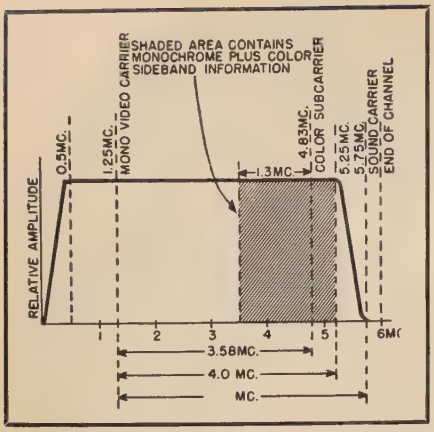


Fig. 2. Color signal characteristics.

standard monochrome transmission is the essential characteristic of the signal. When a color signal is transmitted, the conventional monochrome receiver will present the picture in shades of black, gray, and white with a negligible trace of the picture's color signal origin. An interesting point is that these black and white pictures usually have better resolution than that obtained from conventional monochrome reception. The reason for this improvement is simply that the transmitters have to be more carefully adjusted to handle the color data on the 3.58 mc. subcarrier and, as a result, the monochrome information is present in more detail.

The conversion of a good monochrome transmitter from black and white to color is simplicity itself. (See Fig. 3.) If a color video signal is already available, either from a color camera or a network link, no changes are required. To get this video information from a network a minor investment in new terminal equipment will be required. Networks will probably be the main source of nationwide color transmissions until a sufficient number of color studios are constructed.

The color studio gear and the camera equipment are somewhat more complicated than their monochrome counterparts. Present color cameras consist of three pickup tubes mounted side by side with each one masked with a proper primary filter. By the use of properly positioned dichroic mirrors (mirrors which reflect light of one color and pass all other colors) the single viewed image of one lens is made to fall on each of the three photosensitive camera surfaces. Since these images must pass through green, red, and blue filters respectively before they strike these surfaces, the three resultant video outputs represent the green, red, and blue signals corresponding to these colors in the original scene.

Progress has already been made toward the development of a *single* camera pickup tube that will put out *three* primary signals (Fig. 1). There is no doubt that technical advances in studio equipment will be made towards simplification. In this connection it is interesting to note that the compatible nature of the signal allo for testing transmitting and receiv equipment by radiating color sign (with FCC approval) without pub announcements of the fact. One of first such "sneak" transmissions tc place late in June in New York C on WNBT during a "Howdy Doo program.

The Color Receiver

The color receiver is basically monochrome receiver with additio circuitry. This additional circui falls into two groups. The first gro is that part required by the color formation alone. In Fig. 4 this a is covered by the chroma, decodi color sync, and matrix networks. T part produces as its end product green, red, and blue video signals. T second group is that area of circui dictated by the requirements of picture tube (or display device). Sin Fig. 4 indicates an *RCA* tri-color tu a dynamic convergence network used, as required by this tube.

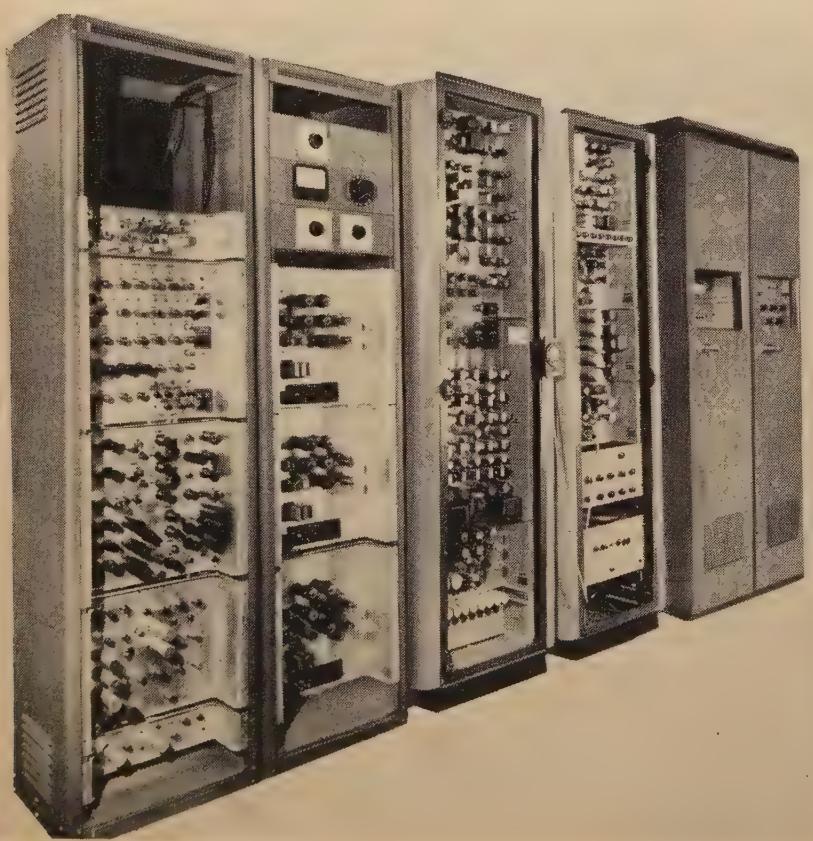
Although the interior of the co receiver is somewhat more comp than its monochrome brother, user's controls are only complica by the addition of *one* more knob. T control is marked "Chroma." It allo a customer who takes issue with mathematically correct ratio of co to monochrome to vary this ratio. T picture color can thus be varied fr a light pastel shading to an inte lush overly-colored display.

With regard to the fine tuning c trol, the public will have to be educated. It will be recalled t split-sound receivers of five years required a careful setting of the f tuning control or there was no sou This careful setting of the tuner os lator made for optimum picture qu ty. However, the problem of oscil tor drift gave way to the use intercarrier systems with the net sult that sound was always pres and tuning the oscillator to obtain best picture became a forgotten ope tion.

In order that the color receiver tain the benefits of intercarrier ope tion and yet force the customer adjust the tuner oscillator to proper place to insure good co quality, the designer is forced to some sort of tuning indicator. In case what could be better than face of the picture tube? The sou traps in the receiver are made sh and deep so that when the oscilla is properly tuned the picture is cle When the oscillator is mistuned picture will show annoying sound p terns.

The most publicized aspect of color TV receiver has been the ture tube. All color tubes preser used or being developed have th color phosphors deposited on the fr face of the picture tube in either a pattern array or a striped patte horizontal or vertical. The *RCA* color tube[1], utilizing three gun str tures is typical of the former ty while the Lawrence tube[2] as made

Color TV signal generating equipment used by Emerson for the design and testing of color TV receivers. Included is a monoscope and flying-spot scanner.



ic Laboratories, containing a
un, is typical of the latter.
RCA picture tube contains a
r dot pattern consisting of
dots in each of three colors
tal of 585,000 dots. The three
e so arranged that each gun
ite only its particular phos-
or. As a consequence it is
and desirable to excite the
ns simultaneously with their
e color signals and thereby
simultaneous light output in
en, and blue. This design does
uire any form of sequential
itching and provides a maxi-
ht output roughly three times
ich would be available on any
al system using this tube. The
hree guns carries with it some
mechanical and electronic cir-
uirements. The first is the
tion that each gun strike its
ve phosphor without contami-
rom the other two. The sec-
he problem of registration of
e colored pictures. Improve-
n the production control of the
tube and in the electronic cir-
ssociated with the tube have
both problems to an accept-
el.

awrence tube contains a series
green, and blue stripes ap-
itely 0.015 inch wide with a
switching grid to allow the
lectron beam to scan any one
epending on the switching po-
present. Because of the single
struction, a sequential display
tial. This means that this tube
suffer from any registration
s. However, it does suffer from
output loss of two-thirds be-
nly one phosphor is in use at
e. There is the additional re-
nt of substantial switching
to the switching electrodes.

est receivers used by the vari-
nufacturers during NTSC field
ave utilized the *RCA* tri-color
xclusively. Although limited
s of the Lawrence tube have
eleased to the industry, a com-
e appraisal is not possible at
e. It is probable that the first
ion color receivers will con-
e *RCA* tube.

ould be quite obvious by now
e color receiver will be some-
nore complex and considerably
expensive than the present
rome receiver. The picture
one is expected to cost from
200 dollars. The tube comple-
f the receiver will fall between
50 tubes. These two factors
make a cost estimate of the
lor receivers fall in the $750
0 class. In addition, these re-
will produce a small picture,
by present-day standards. The
uccessful *RCA* tri-color tube de-
l to date contains an exterior
imilar to the old 16AP4 and
es a 12½" pumpkin-type pic-
Although intensive develop-
work is now going on toward
picture there is no indication

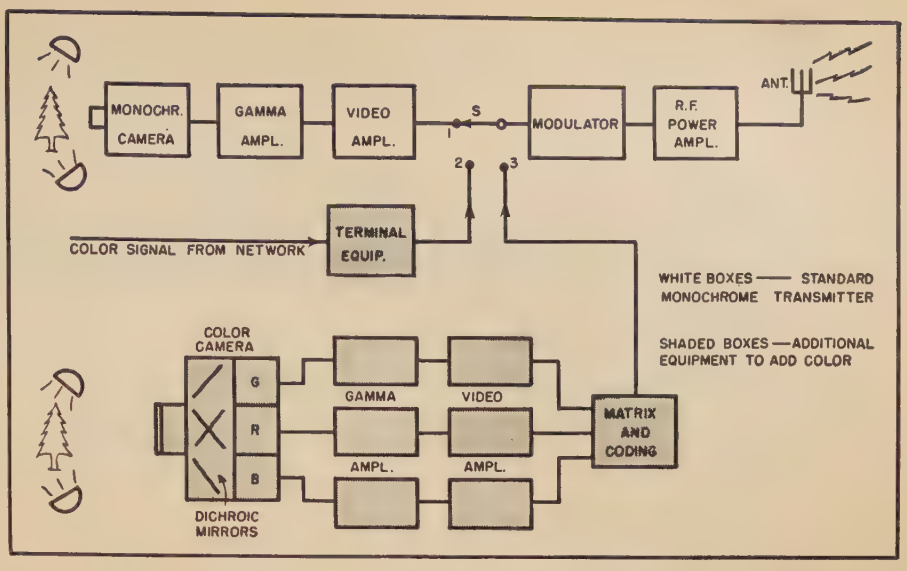


Fig. 3. Simplified block diagram of a typical color television transmitter.

when this larger tube will be available or how much it will cost.

Receiver Production

Obviously there will be no rush to buy the first color receivers. Very few prospective customers will buy a 12½" color picture at $800 in preference to a 21" monochrome picture at $300. However, the novelty is expected to appeal to some, and first production schedules will cater to this rather meager demand.

How soon manufacturers will put color receivers in the field, after FCC approval, is entirely up to the manufacturer himself. There will probably *not* be a repeat of the 630TS experience where *RCA* released complete data on this black and white receiver to their licensees, covering chassis layout, component specifications, alignment procedure, troubleshooting, etc. It will be necessary for each manufacturer to build up a nucleus of engineers familiar with the color TV problem. Fortunately, a number of companies have already done this and have also accumulated a fair amount of specialized test and alignment equipment.

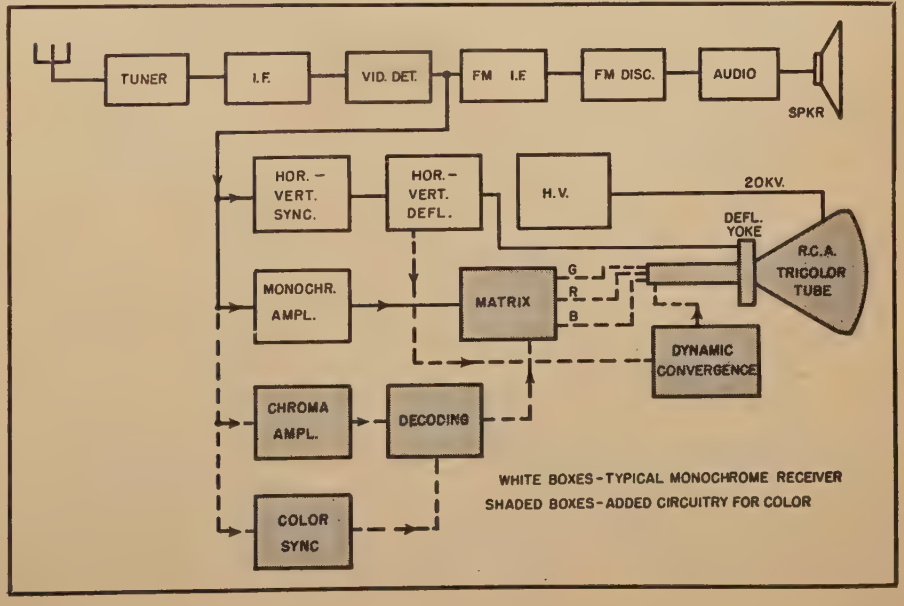
The next step, however, is actual production. The single bottleneck here is the test and alignment equipment for line use. Delivery of this material, from only a few sources, is quoted at from six months to a year. Realizing this, some manufacturers have already placed orders for production test equipment prior to FCC approval. Assuming FCC approval early in 1954, it is safe to say that the first color receiver will be released in the late spring of 1954 with a number of manufacturers in the field by the fall.

The Service Technician

The conscientious service technician who understands the workings of a black and white receiver will not fear the complexities of a color receiver. The transition is not as dramatic as

(*Continued on page* 173)

Fig. 4. Simplified block diagram of a typical color television receiver.



LOUDNESS CONTROL

By **MICHAEL H. ESTKOWSKI**

A tone-compensated volume control which is relatively sim to build and follows the Fletcher-Munson curves very clo

LOUDNESS controls, as opposed to volume controls, have come to mean frequency-compensated, sound-power level controls. This article describes such a control. The various shortcomings of controls available on the market or through technical literature are circumvented in the author's version. Although loudness controls are a controversial topic, several publications have appeared which treat the problem in a rational and experimental manner (See References). For the reader's convenience, the salient factors affecting frequency compensation at various loudness levels are reviewed briefly.

The reference for all tonal compensation of volume controls is the Fletcher-Munson curves, shown in Fig. 1. These curves represent contours of equal hearing loudness at different frequencies over the audio spectrum at various sound-power levels. The upper and lower extremes of these contours are the sense of feel at and above 100 decibels, and the threshold of hearing at 0 decibels. For example, the 40 db curve represents the sound-power necessary at the different frequencies so the hearing loudness will be of equal intensity. Immediately we see that a flat frequency control will not do a satisfactory job at sound-power levels below the originally produced loudness. Unless our nerves are of non-resonant steel, we will not listen to music at its concert hall or dance hall loudness in our 15 foot by 20 foot living rooms.

At first glance we nurse the idea that we can use the bass boost tone control to handle the problem. However, if we want music at about a 50 db level (moderately loud), then from the Fletcher-Munson curves we notice that the volume setting for 25 cps is 35 db above the setting for 1000 cps (the reference frequency of these curves). So, if we look again, we realize that tone controls providing these characteristics are hard to get. If we go to a level of 40 db, the difference between the 25 and 1000 cps settings is about 42 db (40 db level is soft background music—the kind we like with our meals). What average tone control can do this!

Besides these points, there is one more problem to contend with. It is the fact that in using amplifiers for reproducing purposes, the 100 db full-power reference level (threshold of feeling) may be excessively loud. So, it becomes necessary to lower the level of full-power to some appropriate value. As cited in Reference 1, this level is averaged at about the 80 db contour curve. In this case, the necessary compensation is about 14 or 15 db higher than the values given previously.

Nothing has been said about the high frequency end, *i.e.,* frequencies above 1000 cps. The controversy on this point is complicated. However, the Fletcher-Munson curves do show some boost from 5000 cps on up above the 10,000 cps level. This boost exists at all levels of sound, though. The author contends that there is a need for some high-frequency boost above 5000 cps. It is especially true with amplifiers drooping at the high end and rooms where the noise level is above average. Furthermore, people with natural hearing impairments need extra compensation on the high-frequency end.

The author's control was designed to meet these requirements. Circuitwise, the components are non-critical and the network is very simple, Fig. 2A. The volume level does not go all the way to zero, but this is not a fault since at a minimum setting the sound level is at or very close to the threshold of hearing (it can be made to fall in this range). In cases where the listener wants no sound he usually turns off the amplifier or takes the needle off the record.

Electronic operation of the control is based on two sections of *RC* low-frequency crossover circuits. There are three components in each branch, R_1, R_2, C_1 and R_3, R_4, C_2. Values of R_2-C_1 and R_4-C_2 determine the crossover frequency and may therefore be selected to produce the desired acteristic. The function of R_2 a is the flattening of frequency res beyond the crossover point. Ca tions for achieving the desired r are very simple and an example trates the method of procedure.

Assume a value of R_1 to be 1 ohm (a volume control in this and further ascribe the condi that at a minimum setting of R bass frequency of 20 cps is to b tenuated 6 db—a voltage ratio proximately 2. To attain this it is necessary that $X_{C1} + R_2$ at 2 equal 1 megohm. Furthermo crossover frequency of, say, 150 is required. This is done by sele the value of C_1 to have an impe of 1 megohm at 20 cps and temp ily ignoring R_2. Using a reac chart or the *Shure* slide rule, C_1 i μfd. The next step is to find th actance of C_1 at the crossover quency, or 1500 cps. With the value of C_1 the reactance at th sired frequency is 13,300 ohms this stage the value of R_2 may b termined. If R_2 is 13,300 ohms it seem that the crossover would f about 1500 cps and the attenu remain flat from there on in. In tice, however, such is not the The crossover falls about an o higher than the assumed freq by using this method of calcul So, if a resulting crossover freq of 1500 cps is desired then the lations should be based on abou cps. Revising the computation find that X_{C1} at 800 cps is 25,000 in rough figures. R_2 is made ohms. With these conditions th tenuation of 1500 cps at a min setting of R_1 is:

(25,000 + 13,300)/(1,000,000 + 000 + 13,300) = 1/36.9 or abou db.

This method does not produ sharp crossover, but it nevertl approaches the ideal asymptot

y as simple *RC* networks can. mportant part is the fference in attenuation between s and 1500 cps is 25.4 db. Furore, an *RC* network can only maximum attenuation curve of per-octave, and the requirements considerably more than that. fore, by cascading another simiection (in this case R_3, C_2, and he attenuation at a minimum g of both R_1 and R_3 becomes 50.8 he potentiometers are ganged). boost the high frequency output ttings other than maximum a nser shown as C_3 in Fig. 2B may nnected between the tops of R_3 R_5. The effectiveness of C_3 is counled by C_2 and therefore R_5, Fig. about 10,000 ohms may be in-. It is to be noted that the deof high-frequency boost may be olled at will by appropriate valof C_3 and R_6, providing R_6 does not e too large compared to R_5. This fact will introduce an insertion since the total frequency spec- is developed across R_5 and R_6, the output is taken across R_5

sponse curves of the loudness ol of Fig. 2A, are shown in Fig. mparing these with the Fletcherson curves, Fig. 1, we note that ugh they do not coincide, the ap- is close and considerably betan the curves published to date. tening tests proved that the coes a very good job. Some listenemoaned the lack of high-fre- y notes. After inserting C_3 of fd. and R_6 of 0 ohms even these al individuals were satisfied.

nsference of the maximum refer- level, mentioned previously, may lfilled by having a non-compen- volume control ahead of the ol in question. As a matter of he compensated control acts as ry effective bass tone control used with a straight attenuator l of it.

home experimenter will be antly surprised when the control t through its paces. However, building the control care must ken to keep the component parts from electrostatic fields. The t has fairly high impedances and ances which are prone to pick m. To alleviate this situation R_1 R_3 can be 500,000 ohms each. to preserve the attenuation cteristics, C_1, C_2, R_2, and R_4 have changed in accordance with the lations given. The value of R_5 o be high enough to prevent a ing effect on R_3, C_2, and R_4.

sides operating as a non-linear uator of frequencies below the ver point, the loudness control perate as a low-frequency boost- it is the R_g of a preceding vactube stage. That is, if the loudcontrol has a shunting effect on late load of a vacuum tube amation stage feeding into it, then shunting effect decreases with frequencies and causes a higher

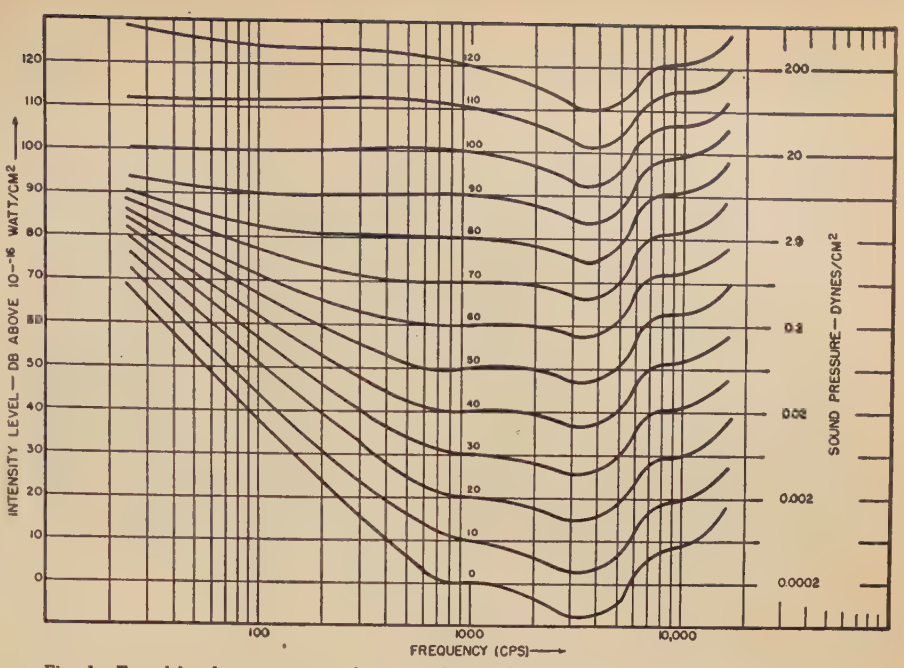


Fig. 1. Equal loudness contours for normal ears, known as the Fletcher-Munson curves.

output signal voltage—as compared to the output at frequencies above the crossover point. In this fashion the control has two simultaneous functions: (1) it acts as a bass boosting complex plate load for a vacuum tube (cancelling the effect of coupling condensers) and (2) it attenuates frequencies in a manner which results in the Fletcher-Munson hearing characteristic curves.

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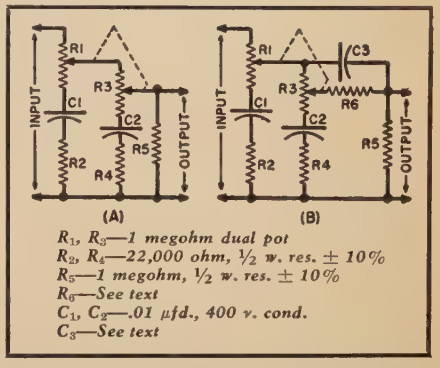
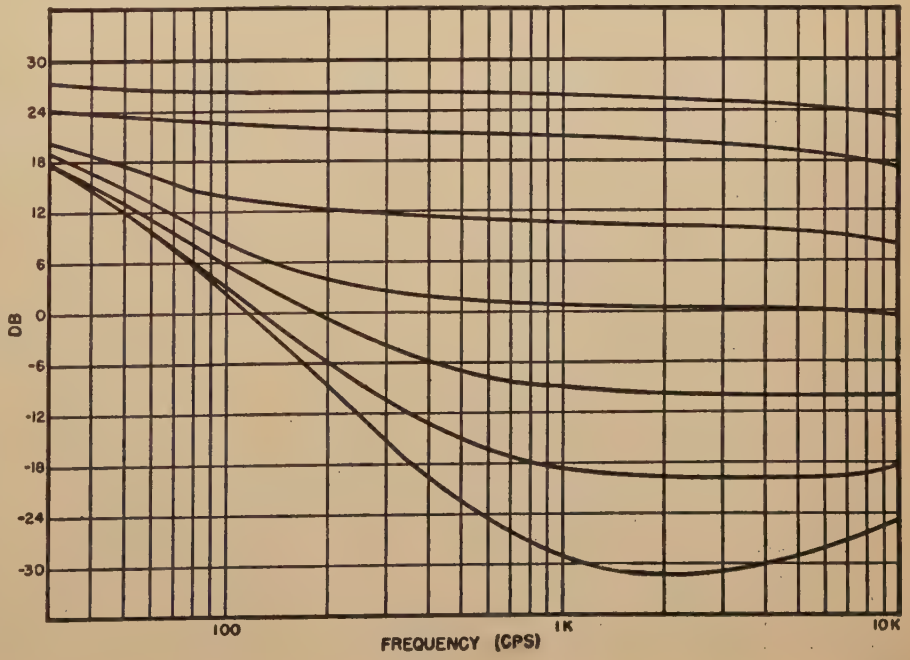


R_1, R_3—1 megohm dual pot
R_2, R_4—22,000 ohm, ½ w. res. ± 10%
R_5—1 megohm, ½ w. res. ± 10%
R_6—See text
C_1, C_2—.01 µfd., 400 v. cond.
C_3—See text

Fig. 2. (A) Basic circuit which produces the frequency response shown in Fig. 3. (B) Addition of C_3 and R_6 makes it possible to increase the output of the high frequencies.

Fig. 3. Response curves of the loudness control circuit shown in Fig. 2A. When pots R_1 and R_3 are set for maximum output, then the frequency response is flat at 30 db across the entire audio spectrum. See text for further discussion of this point.



NEW TV INTERMITTENT CHECKER

By
JOSEPH RACKER
Magne-Pulse Corporation

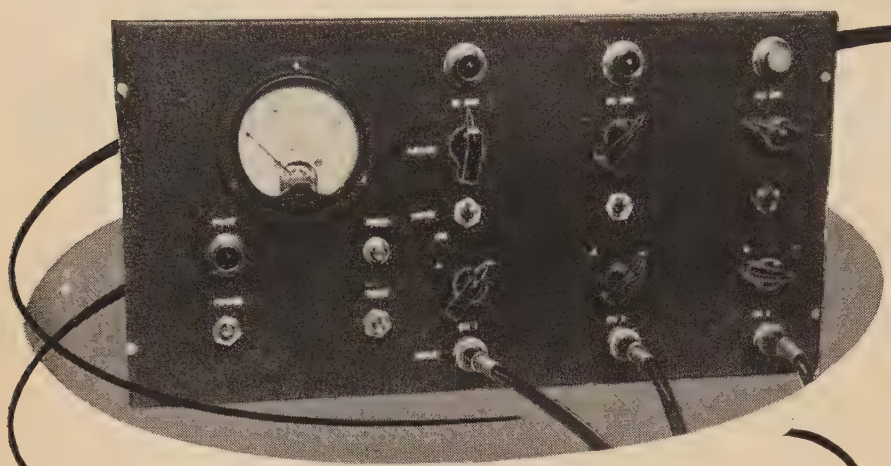


Fig. 1. The Magne-Pulse Type 202 intermittent recorder described in the text.

This new TV service instrument may help eliminate one of the most difficult TV service problems: intermittents.

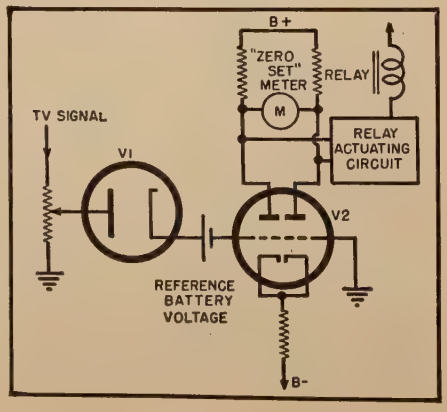
ONE of the most troublesome and time-consuming service faults that the average technician encounters is an intermittent, that is, a trouble that occurs only for a short period of time and then disappears for a much longer time. Not only does such a trouble try the service technician's patience, but equally important, it is often the cause of customer dissatisfaction and many callbacks. Although only about 10% of the sets brought into the shop are intermittents, they often take from 30 to 40% of the technician's time.

A new instrument designed to detect intermittents and localize them to the specific circuits and components in which they occur is shown in Fig. 1. This intermittent recorder is connected to three key points in the intermittent radio or TV set, and the set is turned on. The service technician can then continue to service other sets. When the trouble occurs in the intermittent receiver, the recorder immediately detects it, a buzzer is sounded, and a lamp lights, indicating to the service technician exactly where the intermittent has occurred or is occurring. An important feature of this instrument is that this lamp remains on even if the trouble disappears. Thus, even if the service technician leaves the shop, he will know that an intermittent occurred, and in what circuit.

The intermittent recorder is extremely flexible in that it can monitor any three circuits in the set and can be used to localize the trouble to individual components. If the service technician has no idea where the intermittent is occurring, the three lines can be used, for example, to check the video output, audio output, and high-voltage drive. Assume that the intermittent occurred in the video circuit. The video line lamp lights up. Now the three lines can be placed on three different stages in the video section. The next time the intermittent occurs, the trouble will be localized in a specific stage. Finally, the three lines can be placed at three points within the stage; for example, the grid, cathode, and plate circuit. This enables localization to several components.

The basic circuit of one channel of the intermittent recorder is shown in Fig. 2. V_1 rectifies the input signal from a stage in the TV set. V_2 is a dual-triode used in a balanced circuit. The grid of the first half is biased by

Fig. 2. Simplified basic circuit of one test channel of the intermittent recorder.



the TV signal and the bucking b tery reference voltage. With the receiver operating normally, the tentiometer in the rectifier circui adjusted so that the rectified TV nal voltage exactly equals the batt voltage. This effectively places grid of the first half of V_2 at zero tential and balances the circuit. practice, this is simply done by adj ing the front panel potentiometer responding to the line used fo "zero" meter reading.

When an intermittent occurs, TV voltage varies sufficiently to balance V_2, which results in a vol being applied to the relay actua circuit. Actuation of the relay ca the buzzer to sound, turns on lamp, and "locks out" all other m tor circuits. That is, only the channel in which the intermittent curred will become unbalanced. other circuits which are affecte the intermittent milliseconds late not cause their lamps to light up. example, if three video stages are ing monitored, an intermittent sh ing condenser in the first stage eventually affect voltages in the ond and third stages. However, the circuit monitoring the first s will become unbalanced, since th termittent is occurring in that st The instant that this circuit bec unbalanced, it locks out the stages. Thus, only the lamp of test channel monitoring the first v stage will light up. The test cha in the intermittent recorder pe acceptance of positive or negative and a.c. voltages and cover va ranges of sensitivity.

Some typical servicing experi with the intermittent recorder give some indication of how it ca used. In one case, the customer plained that the picture on his T intermittently became narrow, margins would be seen on both and right. This happened after set (a *Motorola* 16K2) was turne for about one hour. Obviously horizontal drive voltage was dec ing. The intermittent recorder therefore, connected directly to circuits in the horizontal drive. most sensitive test line was conn to the grid of the horizontal o tube, which checked all circuits

(*Continued on page* 196)

LECTRONIC SHIPYARD FOR WINTER CASH

By **ELBERT ROBBERSON**

The time to start rehabilitation and repair of the electronic gear is when the boats come into the yard for winter storage.

Stagger your work load and stabilize your income by setting up a plan for handling your marine service work "off season".

IRST winter in the marine-io business was cold! But in spring the way to pay the off-rent became obvious: operate ctronic shipyard!" When the l hauls a boat, you haul the ic gear in for a winter check-d safe warm storage.

been called to service a line-oats that had just been dunked, owners were breathing down k. In each case, after checking ernal connections of the radio-e, and opening the cabinet to voltmeter on the "B-plus," I ped the "on" switch—and got ! In a couple of cases there "-voltage, but also a wisp of

boatmen had economized by everything aboard through ter. Anyone who has climbed a boat early some wintery has seen condensed water ng on all the metal in the It happens inside equipment as outside, so after a few months er plates grow a beard, con-rrode, and insulators turn into de resistors. I resolved that nter, every piece of gear pos-uld come into the shop. After d out an assembly-line process rned into a profitable proced-ich can well be used by any-he game.

e importance of proper winter in doubt, here are some statis-ake three groups: (1) equip-ft aboard all winter; (2) equip-emoved by the owner or ship-echanics; and (3) equipment l, stored, and reconditioned by e-radio technician.

In 90% of the vessels in case (1), when I was called to fire up the equipment in the spring, it had to be marked "Dead on Arrival." The 10% that worked were in boats that kept heat up, either by warm inside storage or other arrangements. The main causes of failure ranged from sticking vibrators to grass growing in the condensers, but a thorough shop check was indicated in every case, even though a little work on the spot might induce the set to show life. For instance, a stuck vibrator might be shock treated, by a stiff belt with the handle of a screwdriver, and the "B-plus" would come up—then it would drop and all that would be needed for smoke signaling would be an Indian blanket.

The boats in category (2) averaged about 50-50. The troubles were slightly different, but troubles there would be. After the vibrator was induced to buzz, the set might work, but not very well. Trouble ranged from the receiver being dead, because the owner had noticed a bunch of loose screws which he had of course tightened (the i.f. and front-end tuning adjustments, naturally); short-circuited transmitter-coil turns, dropping output to zero or just slightly more; to the bitter extreme of a reversed battery hookup causing electrolytic destruction of metal fittings and engine parts below the water line.

I went aboard one such boat on a service call and found it sinking. A hurry-up call to the shipyard got the vessel hauled out just a little before the time when fish would have been swimming in and out of the portholes. Inspection showed the propeller shaft to be dissolved to the size of a pencil, the propeller a delicate bit of bronze lace, and some fittings were completely absent. To save money, the owner had connected up his own radiotelephone—backwards! Full battery voltage was put between the engine fittings and the ground plate, and the seagoing demon, electrolysis, sat down to the table for a full meal.

Failures on boats in group (3) were almost nil. Whenever trouble showed it was from causes external to the equipment, such as dead batteries, or short-circuited antenna insulators—all things easily corrected at the time of equipment re-installation.

There is just one big question mark, and that is: how can money be made on winter-storage service? Without an efficient system, time is wasted in travel and set-up for service, and the cost may be out of proportion to the job.

Preparation is required, both in the "administrative" department and in the shop. Toward fall, send a letter to every prospect offering the service. Customers like to know what they are getting into, so outline your rates. Labor may be charged for by the hour,

(*Continued on page* 189)

SKIATRON'S "SUBSCRIBER-VISION"

By
RUDOLF F. GRAF

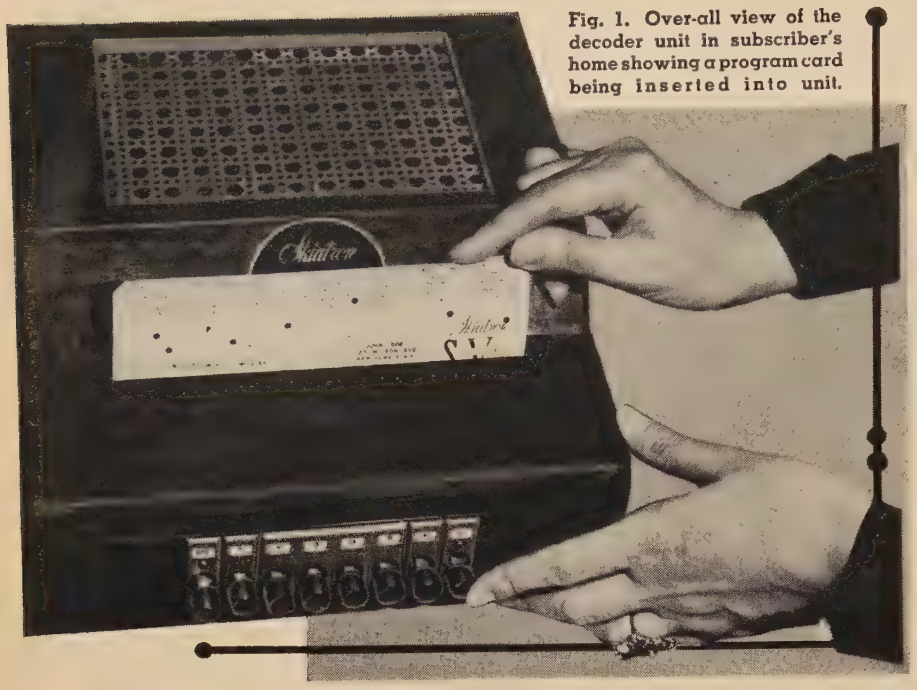


Fig. 1. Over-all view of the decoder unit in subscriber's home showing a program card being inserted into unit.

Utilizing a program card which carries a printed circuit to complete connection, this system is now being demonstrated.

A NEW electronic system for the transmission of scrambled video and sound signals from a TV station and their unscrambling at the home of subscribers was demonstrated to a New York audience recently by *Skiatron Electronics & Television Corp.*

Basically, the "Subscriber-Vision" system of TV transmission and reception is not too complex. The picture as well as the sound signal is transmitted by a regular television station on its assigned channel. The station, however, must be equipped with an "S-V" coder unit. The coder scrambles the picture and sound signals in any desired random or regular manner. If this signal is picked up by any set not equipped with a decoder, the sound is completely unintelligible and the image on the screen is a multiple one.

At the receiving end, the set owner-subscriber has a small decoding unit which can be easily connected to any TV receiver. The decoder may be either a small box-like unit, as shown in Fig. 1, or the decoder circuit may be built into the receiver itself at the time of manufacture. The function of this decoder unit is exactly the opposite of that of the coder unit at the transmitter. It takes the scrambled picture and sound and unscrambles it.

The Decoder

The decoder operates in the following manner. As can be seen from Fig. 1, a card is inserted into a slot in the decoder. This card looks very much like an *IBM* card and carries the codes that are used for the programs covered by the card. The programs for the week are listed on top of the card and the codes corresponding to these programs are contained in printed circuits on the lower part of the card. The card used at the demonstration listed seven programs, one for each day of the week. The subscriber selects his program on the card and when that program is about to start he depresses the corresponding push-button on the decoder unit. This push-button actuates a switch which connects the proper circuits in the decoder and the picture is unscrambled. As soon as any push-button is depressed, a small hole is punched into the subscription card so that there is proof that a certain program has been seen and should be billed.

Coding of the Signal

The transmitter and receiver block diagrams are shown in Figs. 2 and 5 with the additional equipment required for the "Subscriber-Vision" system shown within the dotted boxes.

In transmission, the picture is shifted several times in the horizontal direction. Thus, the video signal of several fields is shifted with respect to the horizontal sync pulses in such a manner that there is quite a noticeable phase shift between fields. In this way a series of pictures is transmitted each of which is complete in itself but jiggles back and forth in a horizontal direction. This multiple transmission can consist of two or three or as many as five, six, or seven images. Furthermore, the fields do not necessarily have to appear in sequence. For example, let's assume the system deals with four pictures and see how this process is handled.

These four pictures could be sent out in the order: 1, 2, 3, 4, 1, 2, 3, 4, or they could be transmitted as 4, 3, 2, 1, 4, 2, 1, or 4, 2, 3, 1, 4, 2, 3, 1, or 4, 1, 3, 2, 1, 3, 2, or any of the other possible combinations. If we choose any of these or another similar code and repeat that sequence continuously, we have a code which varies at a regular rate. If the sequence varies in an unpredictable manner, we have a "random" code.

It can be seen that there is a tremendous number of possible combinations of horizontal displacements. The only problem left is to select a code which can be represented on the subscriber's card and yet be reasonably secret and tamper-proof. This can be accomplished quite easily as will be discussed.

The Transmitter

Three blocks in Fig. 2 make up the heart of the video coding unit. These are the "Field Selector," the "Switching and Coding Circuit," and the "Sync Generators #1, #2, #3." In order to simplify the explanation of this system, we have chosen a code which has a maximum variation of three, so that the picture will be in any of three positions at all times.

First let us consider the type of code used and then we will see how it is produced by these circuits. The present system works with a code that is basic with each card. That is, that as soon as the card is inserted in the decoder, some of its twenty-four contacts establish a basic code. This code is shown as the "Code for the Week" at the top of Fig. 4. Note that the code is incomplete by itself (the third space is blank) and must be filled in.

Even though the "Code for the Week" may be quite involved, the "filling in" may be accomplished by a very simple sequence such as 2, 1, 2, 1, or 3, 1, 3, 1, 3, 1 or 3, 2, 3, 2, etc. or any other sequence that may be set up. These numbers refer, of course, to the relative position of each field at any one particular time. If we study the sample code for a minute, we see that the pi

do quite a bit of moving along screen of the tube. Although it look like a jumbled mess, there till a fixed sequence that is fol-ed.

he input and output signals of the eep Generators" are shown in Fig. Into the circuit come horizontal c pulses which hold the whole g in phase. Coming out of these uits are three horizontal sweep nals of exactly the same frequency, each slightly displaced from the er. The three signals are desig-ed as *A*, *B*, and *C*.

he "Field Selector" feeds rectan-ar pulses into the "Switching and ling Circuit." These pulses take up time of a complete field. Now, in er to put everything together, we e to refer back to Fig. 4 again. We work with the code for program which has a sequence 1, 3, 3, 2, 3, , 2, 3, 1, 1, 1, 2, 3, etc.

he pulses shown at "A" are vertical c pulses. They appear at a field e. Thus the space between them is field. In order to understand the tem more easily, the spaces be-en each of these pulses have been d in with the code numbers of pro-m "Y." Therefore, the code se-nce is actually the field sequence. we now realize that the output tages from "Sweep Generators #1, , and #3, are used for fields 1, 2, 3 respectively, we have the puz-almost solved. All that remains v is to select these pulses at the ht time for the duration of one d. This job is done by the "Switch-Circuit." This circuit receives the are waves produced by the "Field ector" at a rate corresponding to particular code used. These square es are shown in Fig. 4 as "B," "C," "D." The separate sweep volt-s they produce are shown as "E," " and "G" and their combined out-t as "H." Remember that we are e discussing fields and their in-idual lines. What is actually moved the video signal. The horizontal c pulses are not disturbed but the se of the video signal between m is changed every field or so.

As far as the sound signal is con-ned, the coding process is a little s involved. The audio signal is first plitude modulated at a relatively frequency in "Modulator #1." is modulated signal then goes to a quency remodulator where it is ambled at the same rate as the pic-e. This scrambled signal then goes rough a bandpass filter into a con-tional frequency modulator, de-nated as "Modulator #2." Then it transmitted as a scrambled fre-ency-modulated signal.

No decoding pulses are transmitted. e decoding is done entirely at the wer's home by using the proper rd and depressing the correct but-n on the decoder.

The Receiver

The block diagram of the "Sub-riber-Vision" adapted TV receiver is

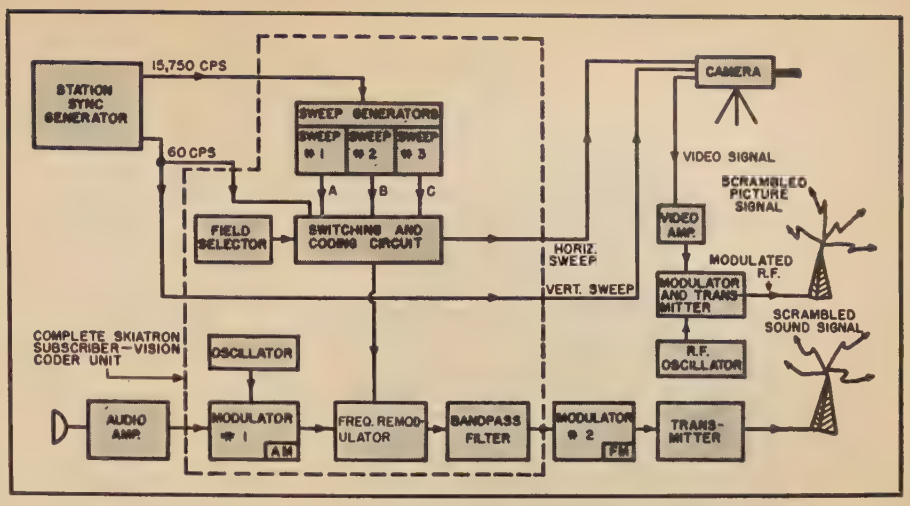


Fig. 2. Block diagram of transmitter adapted to handle S-V coded transmissions.

shown in Fig. 5. Since the problem here is to unscramble a scrambled picture, the circuits used must do essentially the opposite of what is done at the transmitter. Again the vertical and horizontal sync signals are utilized as at the transmitter. They are fed to a "Field Selector" and to "Sweep Generators #1, #2, and #3."

As before, the "Field Selector" feeds rectangular pulses to the "Decoder Unit." These pulses again cover one or more fields depending on the code. The output signals from the three "Sweep Generators" are out-of-phase with each other by exactly the same amount as those at the transmitter. The sequence in which these three signals *A*, *B*, and *C* are used, is determined by the push-button depressed. The bottom part of the program card contains twenty-nine electrically conductive areas which are interconnected in a manner determined by the code used during that

(*Continued on page* 191)

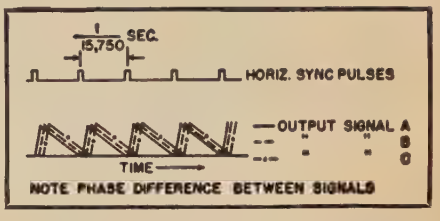


Fig. 3. Output signals of sweep generators #1, #2, #3 of S-V transmission system.

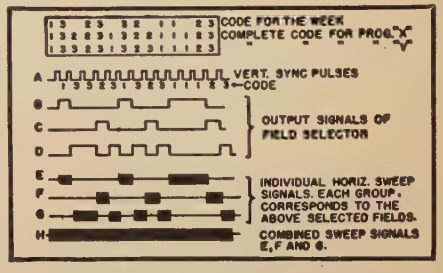
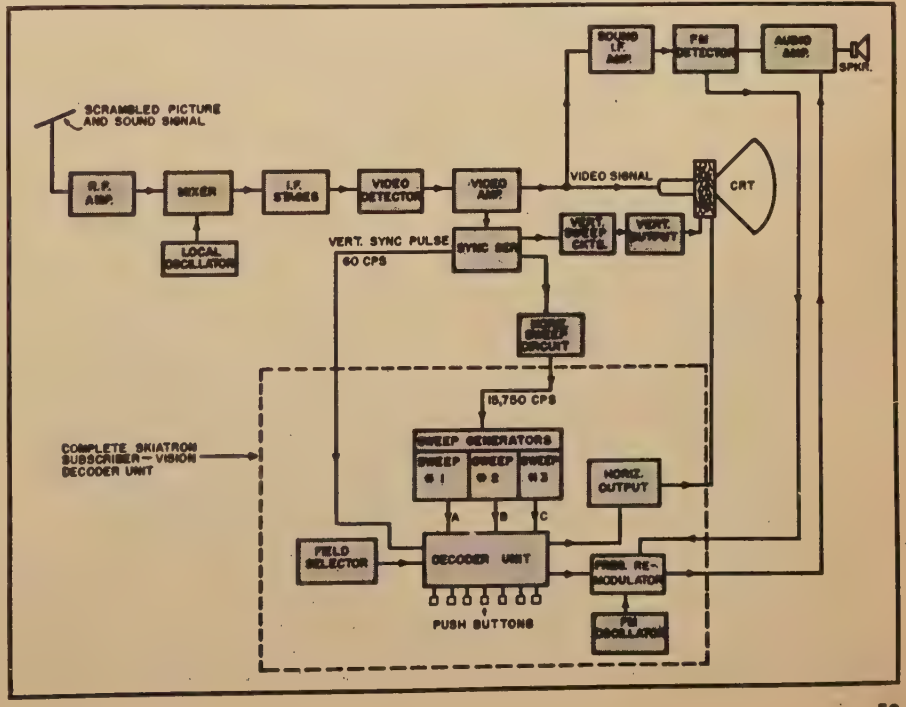


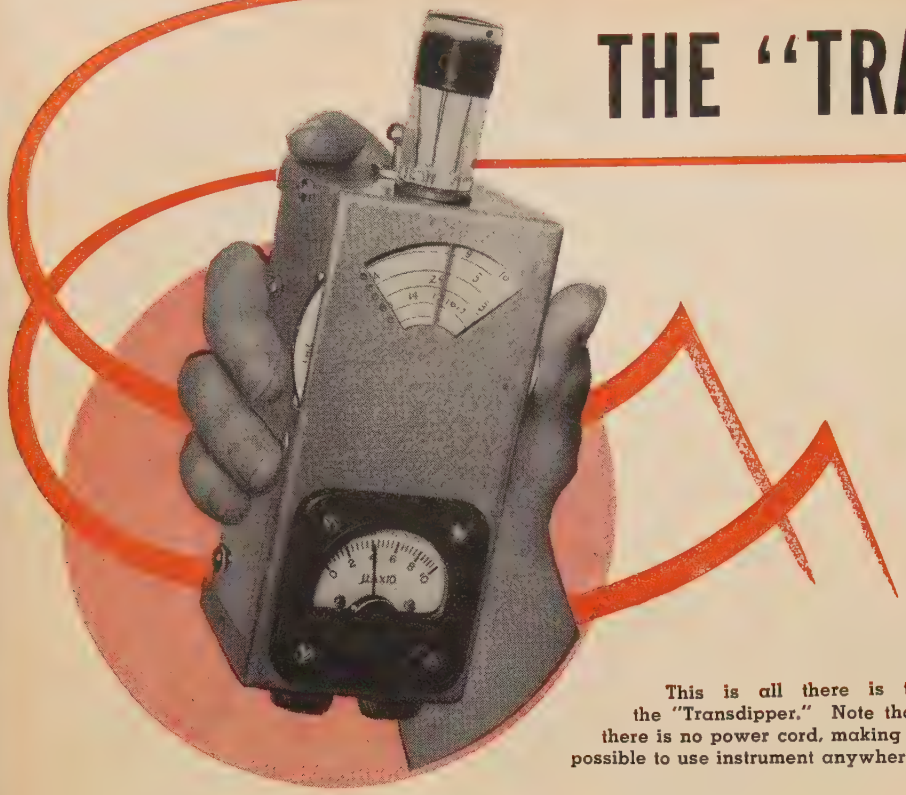
Fig. 4. Signals at field selector and coding and switching circuit of Figs. 2 and 5. See text for details on these patterns.

Fig. 5. Block diagram of the S-V decoder installed in a standard television set.



THE "TRANSDIPPER"

By
C. A. WEST, W2IYG
RCA Tube Department
Harrison, N. J.



This is all there is to the "Transdipper." Note that there is no power cord, making it possible to use instrument anywhere.

A pioneering amateur development in the transistor field, the "Transdipper" is a "grid-dip" meter in its most modern form. Completely self-contained, its range is 1.7-33 mc.

THE difficulties connected with the use of a grid-dip oscillator in adjusting the elements of a parasitic array—dragging a long extension cord and the oscillator with its associated power supply up a steel tower, supporting yourself and the instruments at the top of the tower, and trying to take readings and adjust the elements at the same time—make it plain that a portable, self-powered GDO would be a very handy gadget to have. Such an instrument would find many uses, not only outdoors but in the "shack".

The necessary features for such a gadget include (1) portability, (2) self-contained power supply, (3) compactness, and (4) one-hand operation. In the "Transdipper", which is shown in the over-all photograph, all these features were made practicable through the use of the newest member of the electronic-devices family—the transistor.

The use of an *RCA* 2N33 transistor affords great opportunities for miniaturization and simplicity because this tiny device utilizes no "heater" power, requires no warm-up, and uses little power. The transistor also provides greater stability of operation during handling of the instrument because it is shock-resistant. The "Transdipper" is capable of being held and operated with one hand, and is powered with a small hearing-aid battery. Operating at about 25 milliwatts, it is instant-starting, is extremely stable, and compares favorably for sensitivity with its bigger brothers employing electron tubes.

Design Considerations

The first problem in building a transistor GDO was finding a suitable oscillator circuit of the variable-frequency type. Information on high-frequency transistor oscillators was rather scarce at this stage, but, some basic oscillator circuits were located[1] and the first unit was built breadboard fashion. With the aid of a heterodyne frequency meter and a crystal probe, a variable-frequency oscillator was finally constructed which was reasonably stable.

The next problem, the toughest one of all, was to locate a point or points in the oscillator circuit at which a maximum change in current or voltage occurred when the tank circuit of the oscillator was loaded. Because the input to the oscillator was on the order of 25 milliwatts, it was necessary to use low-range instruments for this search. The idea of using a d.c. instrument as an indicating device was quickly abandoned because changes in direct current readings were never greater, at best, than about 10 per-cent. Because a search for changes in r.f. current or voltage might prove more successful, a crystal probe coupled to a 0-50 μa. d.c. microammeter was used to probe the circuit for r.f. voltage points which would give the desired indication. Although good readings were obtained at various points in the circuit, the changes in r.f. voltage, although much greater than the direct-current changes, were still not entirely satisfactory. At this point it appeared that further improvement in the oscillator circuit itself was in order.

After considerable experimentation it was discovered that the *"Q"* of the tank circuit played an important part as far as sensitivity and maximum r.f. voltage change were concerned. The *"Q"* of the circuit was improved by connecting the transistor base, originally connected at one end to the tank circuit and at the other end to "B+" through a bypassed resistor, to the center tap of the tank coil. An improvement in dip resulted from this change.

Further experimentation with the breadboard model involved circuit modifications which resulted in increasing the output from the oscillator, improving the *"Q"* of the experimental coils, locating a point in the circuit which gave the maximum dip, and eliminating serious false dips. The circuit shown in Fig. 1 was finally developed. In this circuit, which is basically simple, L_1 and C_3 determine the frequency of oscillation. The indicating circuit, a conventional crystal probe with a microammeter in the output, is connected across the tuned tank circuit and indicates r.f. voltage. When the tank circuit is loaded the r.f. voltage drops giving the desired dip in the meter reading.

Possible Layouts

Because further experimentation might prove interesting, it was decided at first to build the "Transdipper" as shown in the drawing of Fig. 1. This type of construction has proved quite popular for certain types of instruments. It is ideal for those who wish to experiment further with the circuit, because it allows use of the instrument during periods of experimentation and provides breadboard layout facilitating experimental work. After some thought, however, the plans for this type of construction were abandoned because they did not lend themselves to one-hand operation or pro-

ruggedness, shielding, and further iaturization.

search for miniature components wed that the indicating instrument ild be the largest component. The tery, tuning condenser, switch, and iable resistors, in that order, are t in size. A number of full-scale wings was made of the parts lay- and parts were rearranged to vide compactness, ease of opera-, and shortest wiring paths. A -piece metal case was finally se- ed; upon completion of construc- and adjustment, the two pieces snapped or screwed together to vide the proper shielding and pro- ion planned for initially. A 2¼" ¼" x 5" *ICA* "Flexi-Mount" case found to be quite satisfactory. final arrangement of parts, shown Figs. 3 and 4, is easily recognized he type used in some commercially ilable grid-dip oscillators employ- an electron tube or tubes.

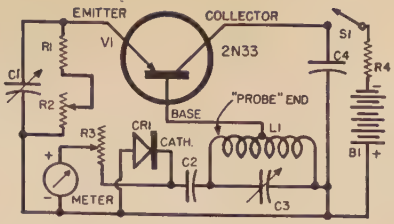
Construction

ecause a suitable dial for the ansdipper" was not commercially ilable, and because this part was only one lacking before construc- could get under way, a home- le dial was devised to fit the in- iment. This dial, which was cut n a one-eighth inch sheet of *Lucite*, trudes from the upper front sides he case for easy manipulation. The is read through a cut-out hole in case. A brass bushing about ¾" iameter and ¼" thick having a hole and set screw was fastened he *Lucite* disc by means of two ntersunk machine screws. A piece white drawing paper was cemented he upper surface to complete the

any of the parts used in the ansdipper" fitted compactly, some rances being as small as 1/32 inch. simpler tuning-condenser mount- is desired, it is quite practical to ch the condenser directly to the er side of the case. The dial may be located on the outside of the , instead of on the inside as shown. is a good idea to solder lengths of e to the terminals before mounting of the components because it may e difficult to reach the terminals a soldering iron after the compo- ts are mounted. The components e mounted in the following order: socket, switch and tuning con- er, meter, and the two variable stors. It is wiser to wire the cir- as the components are installed to install the components com- ely and then attempt to complete wiring, because space is limited. use of a soldering gun for this e of construction is quite helpful.

Coil Design

line with the compact design, *phenol* 24-5H forms were used for coils. The completed coils are vn in Fig. 2. The use of small- coils provides for more convenient ss to tight places when measure-



R_1—3900 ohm, ½ w. res.
R_2—10,000 ohm pot. (IRC Type Q)
R_3—250,000 ohm pot. (IRC Type Q)
R_4—4700 ohm, ½ w. res.
C_1—2.7-30 μμfd. trimmer cond.
C_2—10 μμfd. mica cond.
C_3—50 μμfd. midget var. cond. (Hammarlund HF-50)
C_4—500 μμfd. mica cond.
CR_1—1N34-A crystal diode
Meter—0-100 μa. microammeter (International Instr. Co.)
S_1—S.p.s.t. toggle sw.
B_1—22½ v. "B" battery (RCA VS084)
V_1—2N33 point-contact transistor (RCA)
L_1—1.7-3.6 mc.—93½ t. #28 en. with ½" diam., 1" long slug; 3.1-5.9 mc.—43½ t. #24 en. with ½" diam., 1" long slug; 5.4-10.9 mc.—22½ t. #24 en. with ½" diam., ½" long slug; 10.6-20.5 mc.—10½ t. #24 en. with ½" diam., ¼" long slug; 16.7-33.0 mc.—10½ t. #24 en. spaced to fill 1" winding length

Note: All coils closewound (except 16.7-33.0 mc.) and center-tapped on Amphenol 24-5H ¾" diam. plug-in forms. The slugs are National Moldite Co. products. No slug for 16.7-33.0 mc.

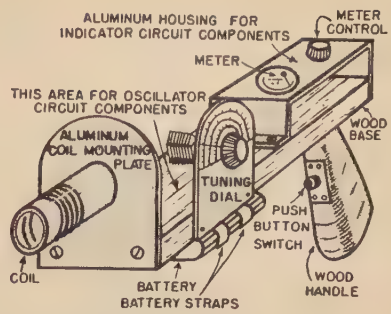


Fig. 1. Complete schematic of the "Transdipper" and an experimental "breadboard" layout which still affords operating convenience. The metering circuit measures changes of r.f. voltage, which is more effective than measuring d.c. current dips.

ments are being made. It is important that coils having a reasonably high "*Q*" be employed with the instrument to help obtain a good dip. Unfortunately, high-"*Q*" coils at first caused greater difficulty with false dips. It was observed during experimentation that the coils used for the low-frequency bands (160 and 80 meters) created the chief difficulty with "*Q*". Powdered-iron slugs were finally provided for four of the five coils to improve the "*Q*". Holes were drilled and tapped in the bottom of the coil form and each slug was screwed into position with the aid of a lock washer and nut. The top of the slug was lined up approximately with the probe end of the coil. The coil data in Fig. 1 gives the necessary specifications for making the five coils which cover the five low-frequency amateur bands.

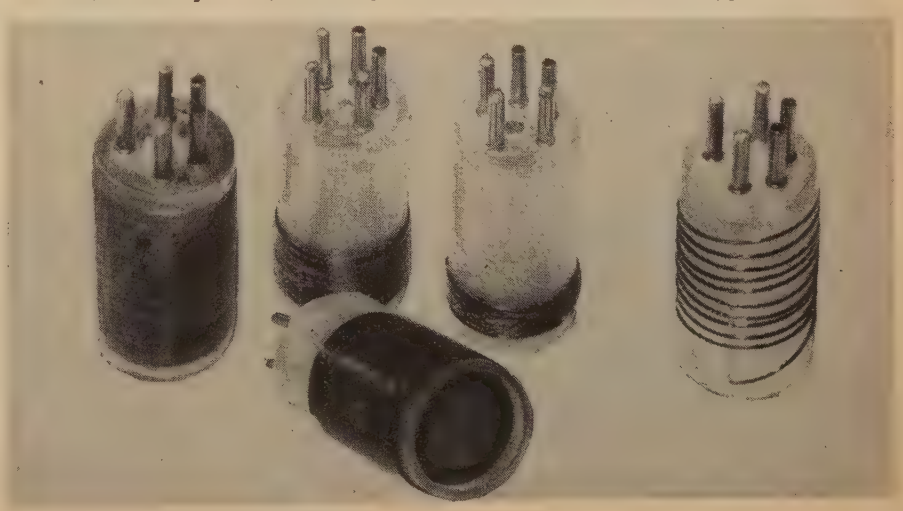
The use of the "Transdipper" can be simplified if the coils are color-coded to match the colored frequency scales on the dial. Upon completion they should be coated to hold the wire in place. A plastic spray is suitable.

Adjustment

Because some readers may wish to build a "Transdipper" for their own use, the remainder of this article is written in a "how-to-do-it" style. Because transistors are rather costly, it is a good idea to double-check the circuit wiring. It is especially important that the correct polarity be used for the battery connections. Transistors are extremely rugged mechanically, but may be easily damaged electrically.[2]

Before the case is assembled connect the instrument to a d.c. source which will supply the proper voltage. A low-range d.c. milliammeter may be used during this initial test to measure the total battery current which is approximately 3.5 ma. It is advisable to turn the switch off before inserting one of the coils. Adjust the meter control knob for maximum re-

Fig. 2. The plug-in coils for the "Transdipper." Left to right, coils for 1.7-3.6 mc., 5.4-10.9 mc., 3.1-5.9 mc., 10.6-20.5 mc., 16.7-33.0 mc. The four lowest-frequency coils have slugs to adjust the "Q" of the coils to obtain reliable "dipping" action.



sistance and apply power. The "Transdipper" microammeter should show a reading indicating that the oscillator is functioning. Now, listen for the oscillator signal with a receiver. The beat-frequency oscillator of the receiver should be turned on. (Incidentally, the 2N33 transistor should not be inserted into or withdrawn from the socket with the power on because high transient currents may cause permanent damage to the transistor.) When the signal is located, it should be checked for frequency stability and tone. Tap the instrument. If the circuit has been wired correctly, satisfactory solder connections made, and components rigidly mounted, the frequency should not change more than a few cycles during this test.

The next step is adjustment of condenser C_1. The emitter resistor R_2 should be set for maximum resistance when this adjustment is made. At the low frequencies a larger value of capacitance is required for C_1 to sustain oscillation than at the high frequencies. To eliminate continual adjustment of this screwdriver control, therefore, it is recommended that the minimum value of capacitance required to sustain oscillation at the lowest frequency be used. This minimum value of capacitance is also suitable for the high frequencies, although better output and dip are obtained when this condenser is adjusted for maximum output on any tuning range. The adjustment of C_1 may be eliminated by the installation of a small fixed condenser in the base of each coil connected to the two unused pins on the coil form. Wire the coil socket accordingly. Select the optimum value of capacitance for each coil range.

Grasp the probe end of the coil and observe the meter reading. If the instrument is operating properly there should be a noticeable dip in current. The case may now be assembled and all coils checked for operation, proper frequency range, and overlap.

Calibration

Because the primary function of a grid-dip oscillator is to determine, conveniently and quickly, the approximate resonant frequency of a tuned circuit, the accuracy of the tuning dial is generally not considered too important. Therefore, the station receiver may be utilized satisfactorily for calibration of the dial.

Calibration of the dial is accomplished by providing a suitable reference line above the dial and, starting with the lowest frequency coil, simply placing a dot on the paper scale below the reference line with a pencil and marking in the frequency. To provide for easy reading of the dial, use the innermost arc for the lowest frequency coil and progress outward during the calibration of the other coils.

The dial may now be inked and, if desired, may be coated with a plastic spray for protection.

Operation

To determine the resonant frequency of an unknown circuit, insert a coil which you anticipate will be suitable. Turn the switch on, adjust the emitter resistor for maximum output, and then set the meter needle to about three quarters of full scale with the meter control potentiometer. Couple the coil of the "Transdipper" *tightly* with the circuit under test and swing the tuning dial slowly over its range. A large dip will occur at resonance. The tight coupling, however, will throw the dial calibration off slightly; the instrument should be backed away, therefore, until only a small dip is observed.

If difficulty is experienced with false dips, readjustment of the emitter condenser or the emitter resistor will help. Locate the largest false dip and maximize output on that frequency. When reasonably high-*"Q"* circuits are checked, the real dip at resonance is unmistakable provided tight coupling is used.

Like conventional grid-dip oscillators, the "Transdipper" may be used as a wavemeter, signal generator, and field-strength meter, and for the determination of values of L or C when one set of values is known.

When the "Transdipper" is used as a wavemeter, leave the switch in the "on" position and gradually approach the source of r.f. The meter will peak sharply at resonance.

Finally, the author wishes to express his appreciation to R. M. Cohen, A. L. Cleland, and D. R. Baird of the *RCA* Tube Department for their valuable suggestions and helpful assistance.

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1. Endres, R. O., Moore, R. P., & Oser, H. A.: "Transistor Oscillators," RCA Review, September 1952.

2. Turner, Rufus P.: "Care of Transistors," Radio & Television News, February 1953.

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Fig. 3. The "Transdipper" is built in half of an ICA "Flexi-Mount" case; other half holds batteries. The positive battery posts are grounded to case by phosphor-bronze springs. Another phosphor-bronze strip contacts the "B-Minus" connection post near the meter. C_3 is mounted on a bracket secured by S_1.

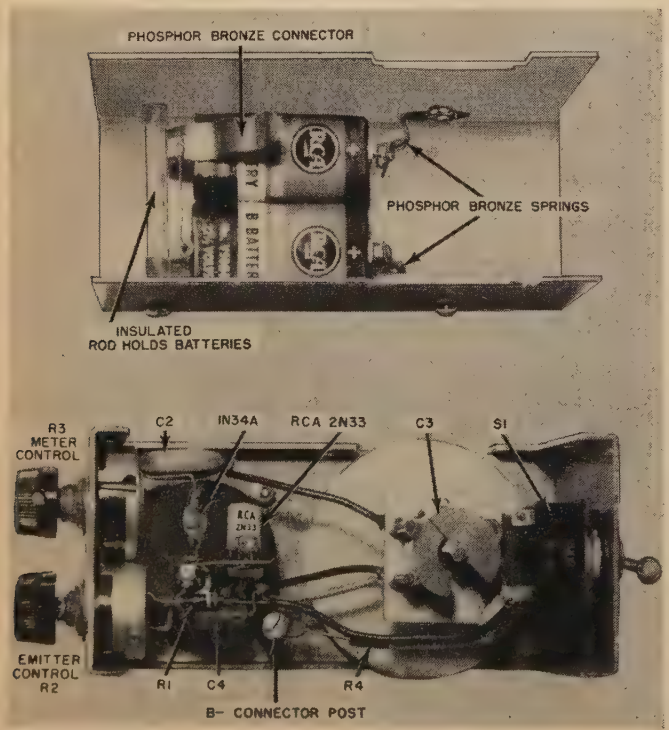
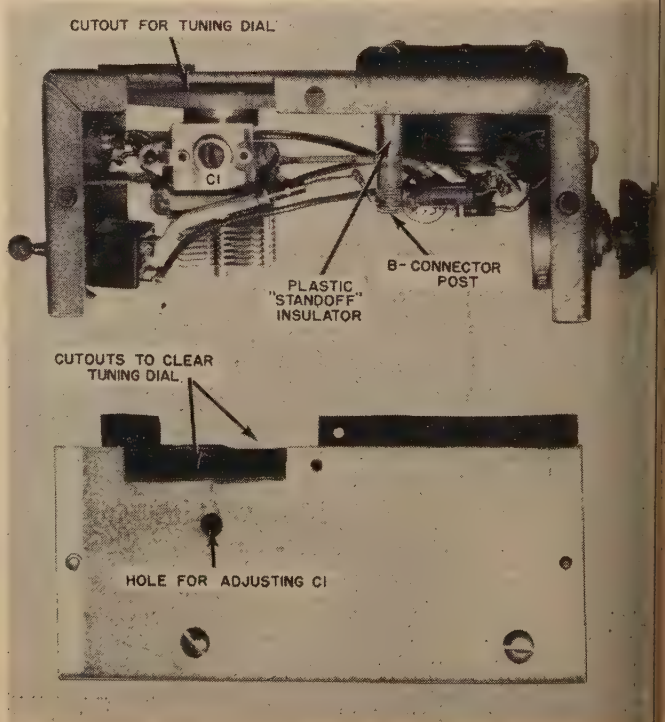


Fig. 4. Side views of the box sections, showing cuts necessary to clear the tuning dial. As the rotor of C_3 is grounded, C_3 may be mounted directly on the side of the box with the dial outside, eliminating cutting. C_1, the emitter condenser, is visible in this view. Its adjusting hole is on other cover.



NOW YOUR 1954 GENERAL ELECTRIC TV RECEIVERS

By

JACK NAJORK

District Service Supervisor
Radio & TV Dept., General Electric Company

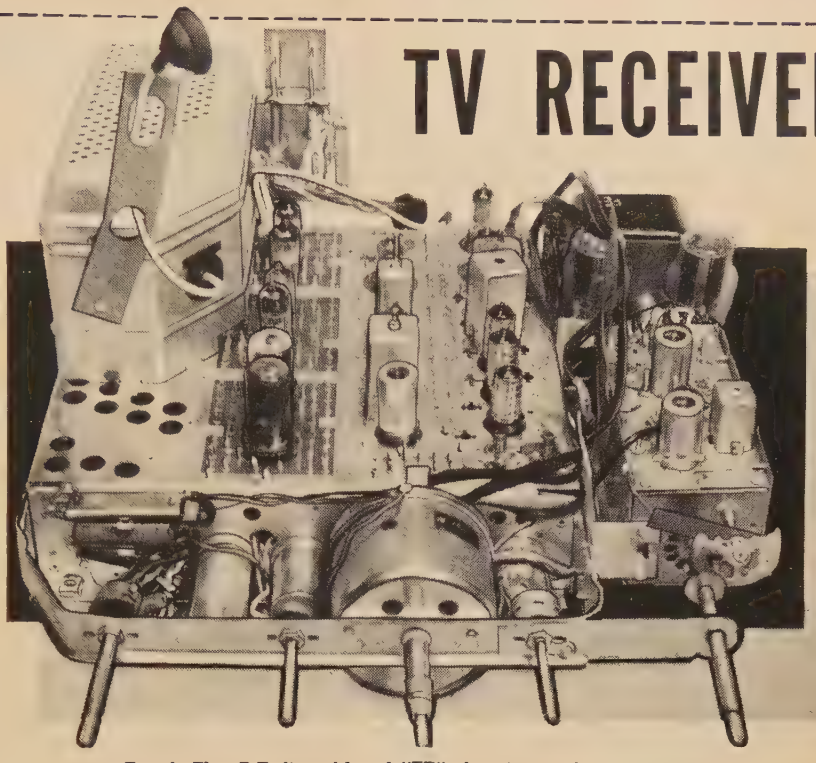


Fig. 1. The G-E dip-soldered "EE" chassis, used in its new TV line.

Complete service data on the new G-E TV sets, including circuit theory, schematic diagram, and service hints.

ALL 1954 *General Electric* television receiver models incorporating the "Ultravision," feature use the "E" chassis described in this article as shown in Fig. 1. This chassis, as well as the standard "F" chassis, are manufactured by a relatively new, mechanized, dip-solder process. Since many service technicians are not familiar with this process and are, therefore, uncertain as to what repair techniques to use when removing or testing components, a brief description of this soldering system follows.

Referring to Fig. 2, four basic steps are involved. For simplicity, the cross-section of only one joint is shown. In actual production, approximately 400 of these joints are soldered simultaneously. The joint base consists of a hollow pin secured in a textolite board; the board, in turn, being riveted to the main chassis deck. These details can be seen from Fig. 1.

In the first assembly step, component leads and wiring are inserted into the pins while the chassis is in an inverted position. When all wiring and components are in place, the completed chassis, still inverted, is dipped into a pool of hot flux. Capillary action draws the flux up into the pin. In the third step, the chassis is dipped into a molten solder pool and capillary action again draws the solder up into the pin. Excess leads are trimmed after the solder has hardened, in the fourth step, and the joint is completed.

In replacing or removing components, the dip-joint can be softened and resoldered from the bottom of the chassis with a small-tipped soldering iron or soldering gun, and the lead pulled out from the hollow pin with long-nosed pliers. The small mass involved, plus the freedom from mechanical twisting and crimping of leads, makes this an easy operation. On ground pins, more heat is required because the pin is directly secured to the metal chassis.

General Circuitry

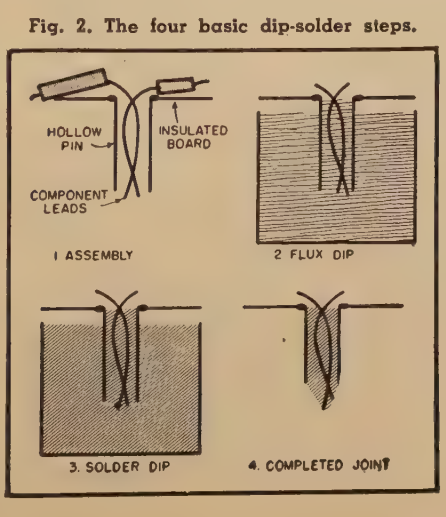
The "EE" chassis and v.h.f. tuner, figs. 3 and 6, employ an improved headend using two r.f. stages with low-noise, grounded-grid input; four video i.f. stages; automatic noise cancellation, horizontal and vertical retrace blanking, and delayed keyed a.g.c.

The built-in, continuous-tuning u.h.f. converter (designated "U.H.F. 70") has, in addition to the continuous tuning range, two "click" positions which can be preset to any two u.h.f. stations.

Head end: The essential features of the "A/K" headend used in previous *General Electric* chassis have been retained in the unit employed with the "EE" chassis. This unit is a switch-type tuner, as can be seen from Fig. 1; its schematic diagram is shown in Fig. 6.

One section of a 6BK7A (early production models use a 6AB4) is used as a low-noise, grounded-grid input stage. The second section of this tube is not used. To obtain the best possible signal-to-noise ratio, the input stage is run wide open at all times; that is, a.g.c. voltage is not applied. The second r.f. stage, a pentode-connected 6AK5, receives a.g.c. voltage from a delayed system. Hence, this stage operates at full gain in weak-signal areas, delivering sufficient signal to the mixer (V_{103B}, ½ 12AT7) to override mixer tube noise and, on stronger signals, the a.g.c. delay is removed and the gain of the 6AK5 is reduced.

Fig. 2. The four basic dip-solder steps.



The output of the mixer is coupled to the first i.f. stage *via* a low impedance coaxial cable. This form of coupling, together with thorough shielding and lead filtering, reduces oscillator radiation to a minimum.

A 40 to 50 mc. trap, L_{106}, in the 6BK7A input stage suppresses signal pickup in the i.f. range and is factory adjusted to 43 mc. In localities where extremely strong signals in the i.f. range are present, added attenuation can be achieved with a shielded, plug-in type high-pass filter which plugs into the headend input terminals at rear of tuner. This filter is normally not supplied with the receiver but is available from *General Electric* distributors, should it be required.

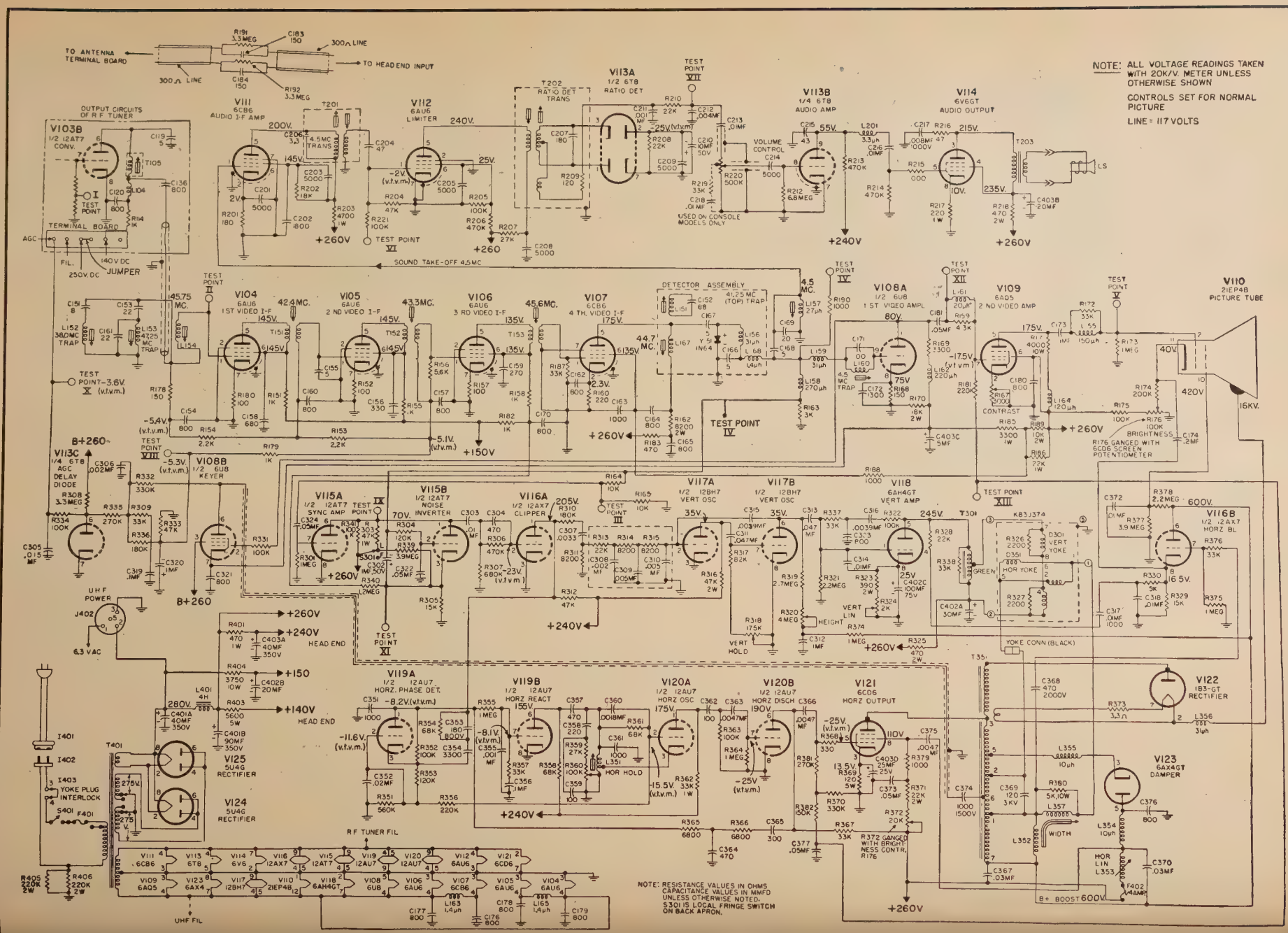


Fig. 3. Schematic diagram of the General Electric "EE" chassis. The tuner schematics are shown in Figs. 5 and 6.

vicing note: When replacing the ." headend in the field, the tech- should make certain to wire umper into the power terminals e headend that supply 250 volts e input stage. Omission of this er, shown on the headend sche- , will cause extremely "snowy" tion in all but very strong signal .

channel: With the exception of ow-impedance input circuit, bi- wound, single-tuned transformers used throughout the stagger- i.f. amplifier (see Fig. 3). Elim- n of the *RC* time-constant in rid circuits contributes material- improved noise characteristics by ving the possibility of grid- ing. An a.g.c. voltage is applied e first three i.f. amplifier tubes. ree traps, tuned to 47.25 mc. cent sound), 41.25 mc. (own l) and 38 mc. (adjacent picture) ncorporated in the i.f. amplifier.

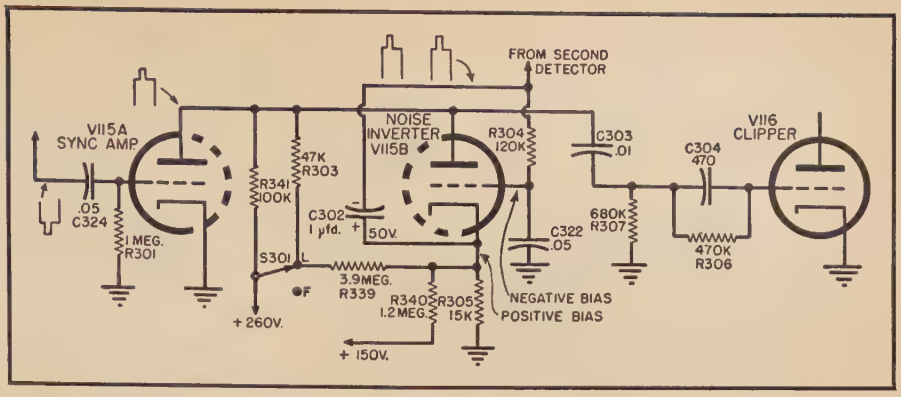
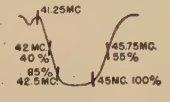
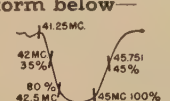


Fig. 4. Partial schematic diagram of the noise inverter circuit used in the G-E "EE" chassis. As shown here, sync pulses are fed to the inverter from two sources.

Since adjacent picture interference normally falls at 39.75 mc. the question arises, "Why trap 38 mc.?" Field experience has shown that, in nearly every case, adjacent-channel picture interference is encountered in fringe areas where the desired signal is weak and the interfering signal is strong. Under such conditions, the receiver's fine tuning control is usually adjusted so that the desired picture carrier rides on the top of the i.f. re-

Table 1. Alignment procedure for the video i.f. and sound circuits of the G-E "EE" chassis.

VIDEO I. F. ALIGNMENT

TEP	SIGNAL GENERATOR FREQUENCY	CONNECT TO	OUTPUT INDICATOR	CONNECT TO	ADJUST	REMARKS
1	41.25 mc. unmodulated	Junction of L_{154} & R_{178} & chassis	Oscilloscope	Test Point 5 (CRT grid)	L_{151} for minimum	Refer to the notes under alignment in the text
2	47.25 mc. unmodulated	Same as above	Same as above	Same as above	L_{153} for minimum	May require maximum oscilloscope vert. gain
3	38.0 mc. unmodulated	Same as above	Same as above	Same as above	L_{152} for minimum	Same as above. If insufficient "null" is obtained turn core of L_{154} two or three turns into coil
4	4.5 mc. unmodulated	Test point 4 (diode load)	Same as above	Same as above (see remarks)	L_{160} for minimum	Connect network shown in Fig. 8 between scope input and receiver test point 5. Remove V_{107}
5	44.0 mc. center freq. 10 mc. sweep	Test point 2 and chassis through .001 μfd. condenser	Same as above. Calibrate vert. gain of scope to provide 2-in. deflection for 1¾ volt peak-to-peak input signal	Test point 3 (junction of R_{164} & R_{165})	T_{151}, T_{152}, T_{153}, & L_{167} for waveform below— 	Picture contrast control should be set to minimum. Apply a negative 6-volt battery bias to test point 8; connect positive lead to chassis
6	44.0 mc. center freq. 10 mc. sweep	Test point 1 & chassis through .001 μfd. condenser	Same as above	Same as above	L_{154} and T_{105} (r.f. tuner) for waveform below— 	

SOUND I. F. ALIGNMENT

7	Tune in a local TV station	V.T.V.M.	Test point 6 & chassis	L_{157} & T_{201} (top & bottom) for maximum	Voltage to be read is negative with respect to chassis
8		Same as above	Pin 2, V_{113A} & chassis	T_{202} primary (bottom) for maximum	
9		Same as above	Test point 7 & center of two 100,000 ohm resistors, see Fig. 9	T_{202} secondary (top) for zero d.c. output	Remove 100,000 ohm resistors after alignment

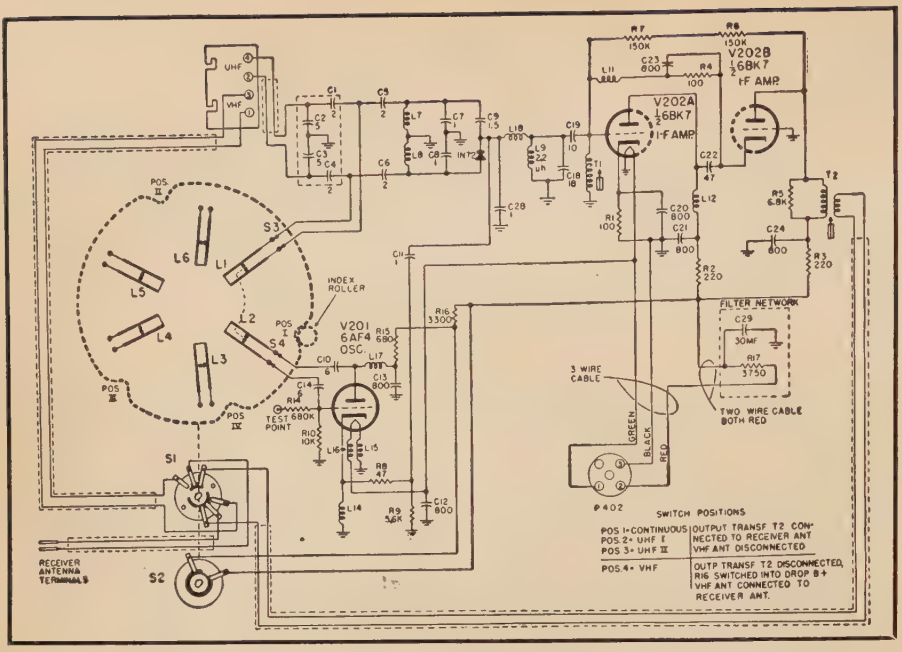
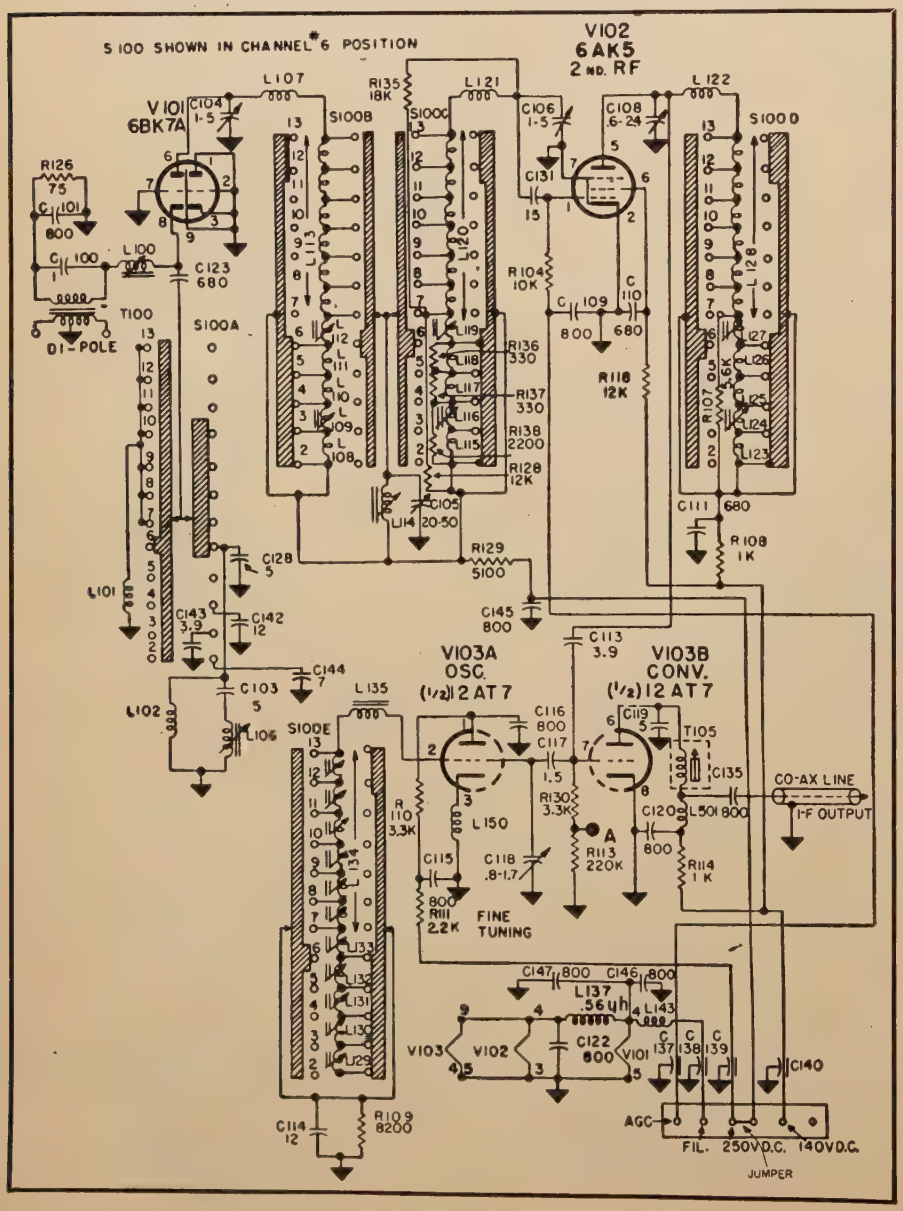


Fig. 5. Schematic of the G-E "U.H.F. 70" converter used with the "EE" chassis.

Fig. 6. Schematic diagram of the v.h.f. tuner of the General Electric "EE" chassis.



sponse curve to obtain more vide output. This point on the i.f. curv generally falls around 44 mc., as show in Fig. 7. This deliberate mistunin of the receiver also changes the i. frequency which corresponds to th interfering adjacent-channel pictur carrier. Thus, if the normal pictur i.f. is 45.75 mc., then adjacent-chann picture equals 39.75 mc. If, howeve the picture carrier is set to 44 mc the adjacent-picture frequency b comes 38 mc. Hence, fringe tunin will drop the adjacent-channel sign into the 38 mc. trap, whereas a 39.7 mc. trap would be ineffectual.

The *approximate* alignment fr quency for each i.f. transformer shown on the schematic, Fig. 3, to f cilitate visual alignment adjustmen only. The use of an AM generator a single-frequency peaking is not recor mended for over-all i.f. alignmen The AM generator can be used, ho ever, to adjust the traps.

Second detector and video amplifie Both 4.5 mc. sound and composi sync are taken off at the second d tector, a 1N64 germanium diode. T sound signal is taken off through t 4.5 mc. tuned circuit L_{157}-C_{169}, and th fed into the 4.5 mc. i.f. amplifier, lim iter, and ratio detector.

An a. c. coupling is used in the tw stage video amplifier which consists t the triode section of a 6U8 and 6AQ5 (later production models use 6CL6).

Noise inverter: Composite sync a video are amplified in V_{116A}, ½ 12AT7, and fed across the noise i verter to the clipper stage, V_{116A}.

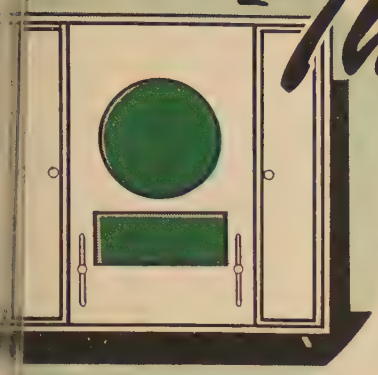
The noise inverter, as the name i plies, actually inverts and cance completely all noise pulses which e ceed the tips of the sync pulse. Th circuit should, therefore, not be co fused with other sync-stabilizing a rangements which simply clip or lim noise pulses to the sync level.

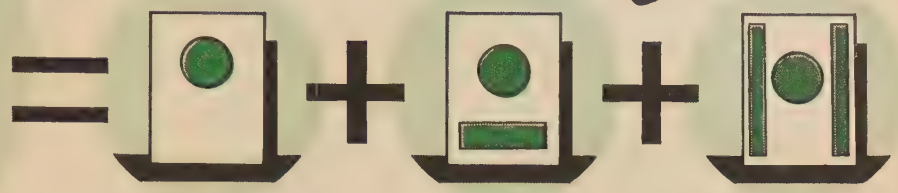
Referring to Fig. 4, the noise i verter tube receives bias from t sources. A fixed, positive voltage applied to the cathode through t networks made up of R_{340}-R_{305} a R_{303}-R_{339}. Negative voltage which var with the *average* signal level is f from the second detector to the g of the noise inverter through R These bias voltages combine to v tually cut off the noise inverter tu in the presence of strong, noise-fr signals.

In addition to supplying bias to t noise inverter grid, the second tector also feeds, from the sam source point, a negative-sync sign through C_{302} to the cathode of t noise inverter. A strong noise pu exceeding sync-tip level at the det tor will, therefore, drive the cath of the noise inverter less positi causing the tube to conduct heavi At the instant of conduction, t plate-cathode circuit of the noise verter looks like a low impedan Since this low impedance path shu the output of the sync amplifier, t

(*Continued on page* 152)

The "Fold-a-flex"





Infinite baffle. Bass reflex. Folded horn.

An original design of an all-purpose loudspeaker enclosure† capable of providing the characteristics of: infinite baffle, bass reflex, or folded horn. Optimum performance of 12-inch or 15-inch speaker systems may be achieved by adjusting the variable port openings.

By
OLIVER READ*

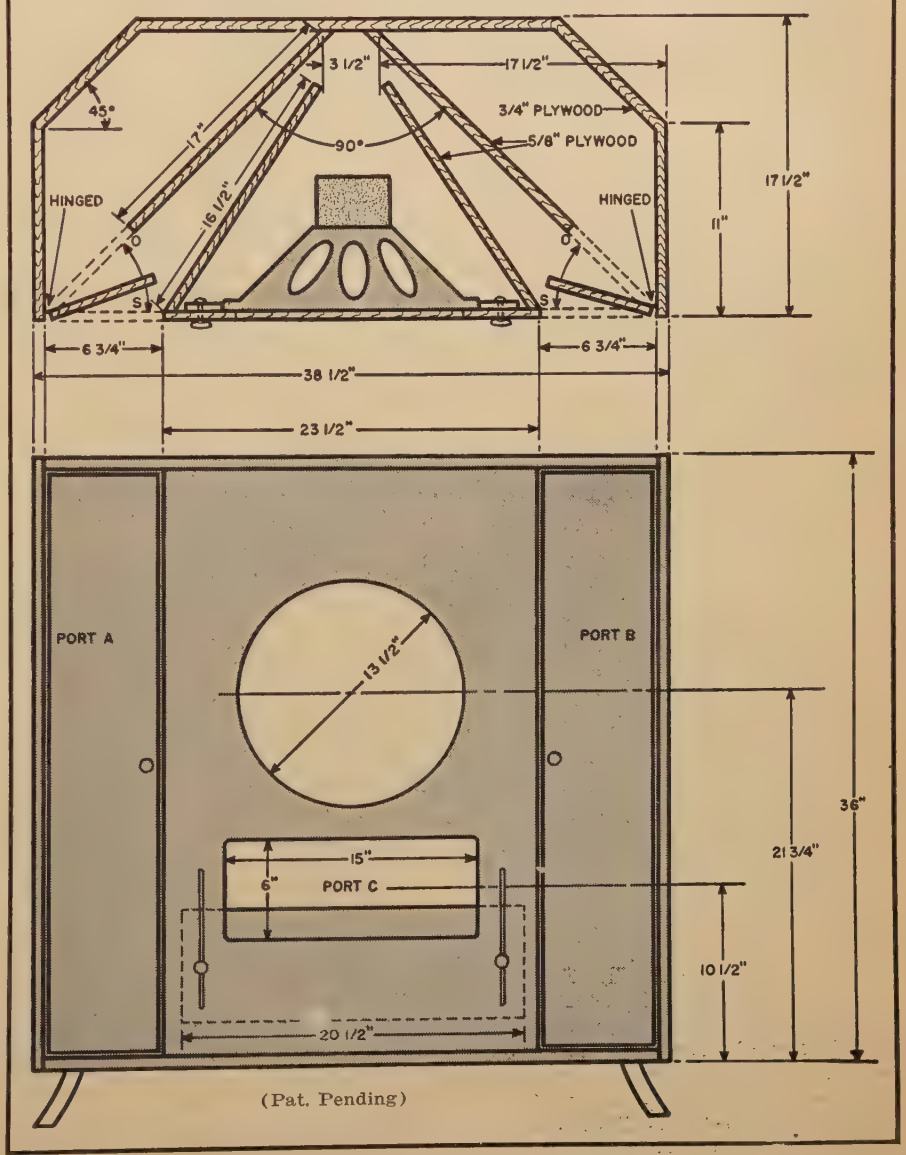
LERS in high-fidelity compo-nents and systems are daily con-fronted with the problem of choos-ing the proper enclosure for a quality speaker installation. Consumers, too, are very much in the dark when it comes to making the proper choice of an enclosure which will be best suited to their own room acoustics and to their particular listening criteria. The *"Fold-a-flex,"* designed by the author, is the result of experiments begun early this year on an enclosure that could have its characteristics altered by some simple mechanical means. As READ *"FOLD-A-FLEX,"* Fig. 1, and data accompanying this article will show, a choice of any one of the three most popular speaker enclosure types may be made.

Infinite Baffle

The design of a loudspeaker enclosure and the choice of amplifier impedance must be based on subjective judgments by the users as to what constitutes "quality" or perhaps simply listening "satisfaction." An important factor determining the transient response of a speaker and cabinet is the amount of damping. The damping may be changed by choice of amplifier impedance and by adjustment of the resistive component of the impedance. The first design criterion which we should attempt to meet is to expand the low-frequency response to as low a frequency as possible. This means that the value of the compliance for the loudspeaker housing should be made as large as possible so that the compliance of the loudspeaker suspension sets a resonant frequency. The rules for a completely enclosed box recommend a volume of 10 cubic feet or more for a 15-inch loudspeaker. *"Fold-a-flex"* provides this type

(*Continued on page* 176)

Fig. 1. The Read "Fold-a-flex" which can provide the characteristics of an infinite baffle, bass reflex, or folded horn by making port changes.



(Pat. Pending)

* Editor and Assistant Publisher, RADIO & TELEVISION NEWS, RADIO-ELECTRONIC ENGINEERING.

† Patent Pending

A TRANSISTOR TIMER

By LOUIS E. GARNER, JR.

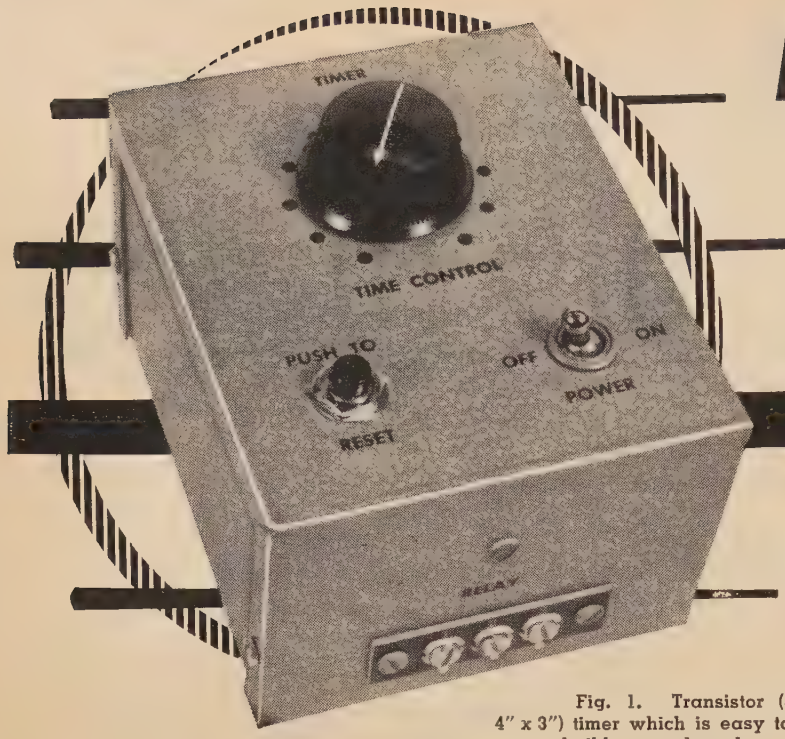


Fig. 1. Transistor (5" x 4" x 3") timer which is easy to operate, easy to build, rugged, and compact.

A "natural" for the photo lab, this timer requires no external power source and offers a wide selection of timing intervals.

MOST electronic timers suffer from two disadvantages—they require a source of line voltage and they become extremely warm when left on for any length of time. Both disadvantages result from the necessity of using vacuum tubes and comparatively high voltages.

Although the necessity of having line voltage available seems like a small problem, occasions do arise when it is desired to control (turn "off" or "on") battery-operated or portable equipment over pre-determined time intervals.

The second disadvantage mentioned is of real importance in some applications. Anyone who has worked in a darkroom in summer soon realizes that *any* heat is too much! Yet it is in the photographic darkroom that a large percentage of electronic timers are employed.

With these problems in mind, an effort was made to design a timer that would meet the following specifications: (a) Simple in construction and wiring; (b) Easy to operate; (c) Completely self-contained, using no line power; (d) Generating as little heat as possible; (e) Rugged, yet compact. The result is shown in Fig. 1.

The timer shown in Fig. 1 is reasonably small (over-all dimensions of the case are 5" x 4" x 3") and lightweight, requires no line voltage, is easy to operate (only three controls —"Power" switch, "Reset" button, and "Time Control"), produces virtually no heat in its operation, and yet is fairly simple to wire (refer to the schematic diagram of Fig. 2).

All of these features have been made possible by employing a *Raytheon* Type CK722 junction transistor as a control element in place of the usual vacuum tube and providing for battery operation. Battery life is unusually long, since the maximum current drain is only slightly over a milliampere, and this only for short periods. In fact, the battery life should equal the normal "shelf life" of the units.

Circuit Description

The operation of the circuit is not at all complex, as can be readily observed by reference to the schematic diagram of Fig. 2.

In operation, when the "Power" switch, S_2, is closed, current can flow through R_2 and R_1, charging condenser C_1 and permitting a momentary surge of base current. The base current flow, in turn, permits collector current to flow, closing the relay.

As soon as condenser C_1 is charged, the current flow over the R_2, R_1, C_1 and the base-emitter path ceases. The drop in base current flow to virtually zero results in a corresponding drop in collector current flow, permitting the relay to open or "drop out."

The time period in which the relay "holds in" depends on the period of collector current flow, which, in turn, depends on the time it takes condenser C_1 to charge. This, in turn, depends on the time constant of C_1, R_1, R_2 and the base-emitter impedance.

If any of the parameters in the charging circuit thus formed are changed, then the time interval must be changed. In practice, an adjustable time interval is obtained by using a rheostat for R_2, keeping R_1 at small value simply to limit base current flow and hence to protect the transistor. However, if fixed timing intervals are desired instead of a continuously adjustable control, a single fixed resistor may be used in place of R_1 and R_2, and different values of C_1 chosen by using a conventional selector switch.

Once the unit is "set-up" for operation as described, the desired "timing interval" is selected by adjusting R_2. The "Reset" switch, S_1, is then depressed, shorting out and discharging C_1. When the "Reset" switch is released, C_1 starts to charge again and the relay closes, opening again after C_1 is charged. The timing interval may be repeated as often as desired simply by depressing and releasing the "Reset" button.

The layout and parts arrangement used by the author are readily seen by referring to the interior and exterior photographs of the model given in Figs. 3 and 1, respectively. As is easily seen, no attempt was made to "miniaturize" the model and hence there is no crowding of parts. Because of this, wiring the unit should be simple, even if the builder is not highly skilled.

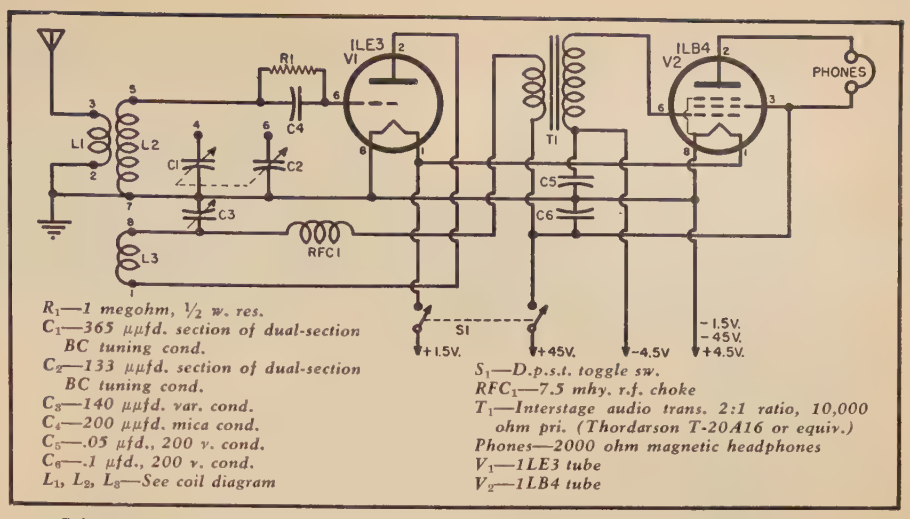
Leads can be any length desired and the builder may use either "point-to-point" or "right-angle cabled" wiring, or a combination of both, as he prefers.

Although the author wired the transistor directly into the circuit by soldering the leads, the builder might prefer to use a socket—an ordinary 5-pin flat subminiature tube socket is employed. Should the builder follow the author's practice, however, take care to keep the transistor leads at least an inch long and do the soldering as quickly as possible to avoid overheating and damaging the transistor. Use the same "safety rules

receiver was constructed in a cabinet 8" wide, 8" deep, and 7" and having a hinged lid on top. en-ended chassis 7" x 7" x 1½" ttached to the panel by means switch and phone-jack mount- o that the panel and chassis be removed as a unit. Because lange around the front edge of binet, it was necessary to mount strips ½" thick and 1½" wide e floor of the cabinet running ront to back to form a support e chassis. Access to a binding- strip on the back end of the s was made by sawing a window 6¼" in the back of the cabinet ch from the bottom. Antenna attery terminals were mounted strip of *Micarta,* and soldering were used on the under side. g posts were made from 6-32 screws and knurled brass nuts from an old battery. Large were drilled in the chassis un- e binding-post strip to permit rip to be mounted flush. Two ded binding posts were attached y to the chassis beside the strip. gh this makes a neat arrange- battery connections could be by using flexible leads running h a rubber grommet in the s directly to points where they t. A battery tray 3" x 7" was by bending up a sheet of alumi- t the long sides. This serves to batteries from sliding into the parts when the receiver is

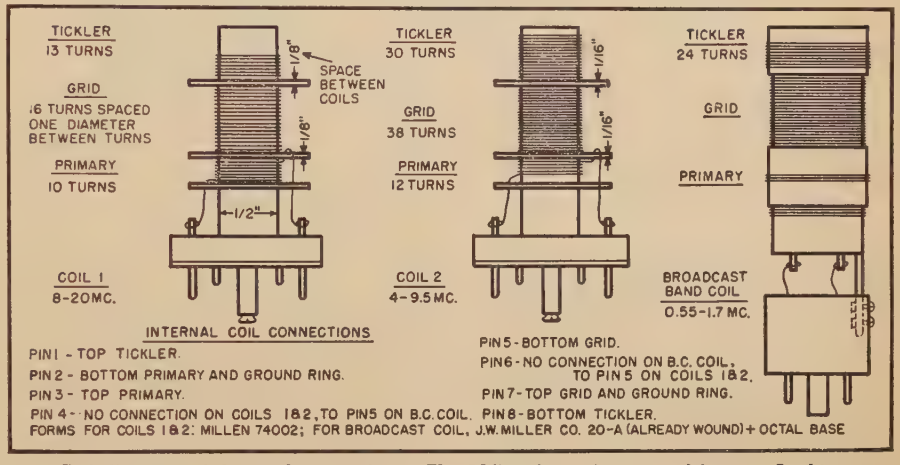
layout drawing and the photo- s show the mounting of essen- parts. The arrangement used o to be most satisfactory, and s short coil and detector cir- leads. Small variations may o be made, however, to accom- e parts of different sizes. The condenser was mounted on an bracket attached to the floor e chassis. This bracket was and positioned with care in order to align it properly with the vernier dial mounted on the panel. A flexible metal coupling between the

(*Continued on page* 185)



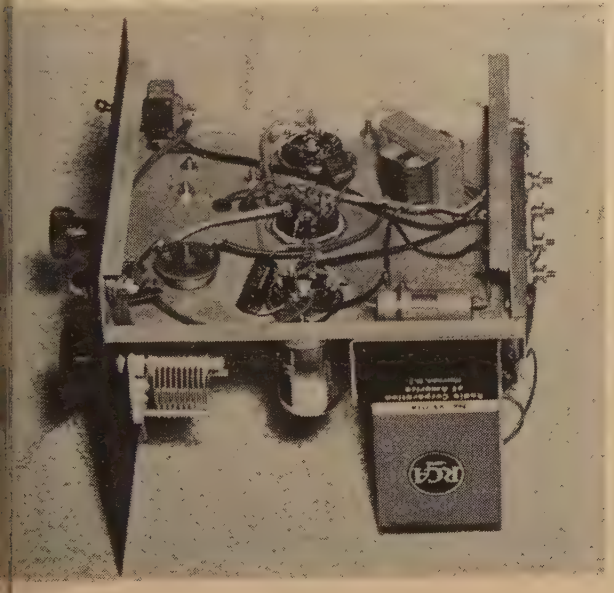
R_1—1 megohm, ½ w. res.
C_1—365 μμfd. section of dual-section BC tuning cond.
C_2—133 μμfd. section of dual-section BC tuning cond.
C_3—140 μμfd. var. cond.
C_4—200 μμfd. mica cond.
C_5—.05 μfd., 200 v. cond.
C_6—.1 μfd., 200 v. cond.
L_1, L_2, L_3—See coil diagram
S_1—D.p.s.t. toggle sw.
RFC_1—7.5 mhy. r.f. choke
T_1—Interstage audio trans. 2:1 ratio, 10,000 ohm pri. (Thordarson T-20A16 or equiv.)
Phones—2000 ohm magnetic headphones
V_1—1LE3 tube
V_2—1LB4 tube

Schematic and parts list for regenerative receiver. The numbers in the tuning circuit refer to pins on the octal socket used for the coils. The proper tuning condenser for each band (C_1 or C_2) is connected through the coil form wiring (diagram below). C_3 is regeneration control. If set does not regenerate, reverse the connections of L_3. Set should be connected to external ground by fairly short lead.

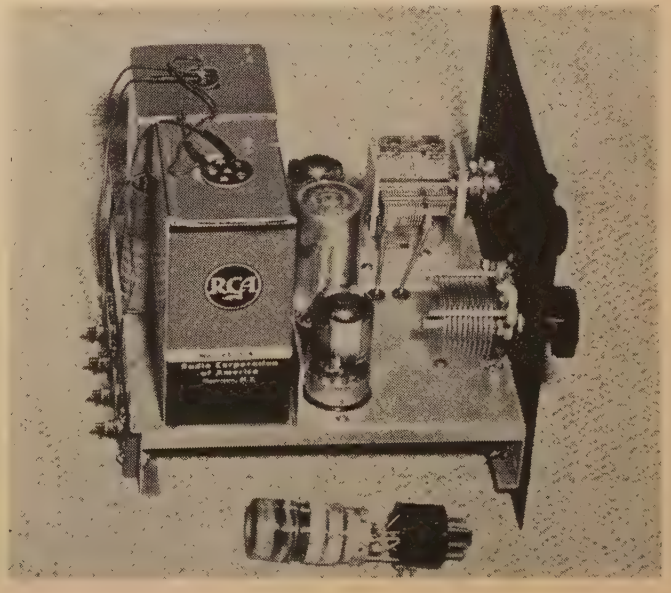


Coil diagram of the student receiver. The Millen forms have octal bases. Looking at the bottom of a form, with the octal key pointing down, pin 1 is to the lower left of key; other pins are counted clockwise from pin 1. The broadcast coil is ready-made (J. W. Miller Co. No. 20-A) and is attached to an old octal tube base.

m view of chassis, showing neat and roomy layout of parts. round object at left is the 7.5 mhy. plate-circuit choke.



Top view. Short-wave coil is in place, covered by a Millen shield which is part of coil form. Broadcast coil is in front.



BRING YOUR TV SET UP-TO-DATE

By **RICHARD C. KOCH**
Senior Project Engineer
Regency Div., I.D.E.A., Inc.

Fig. 1. A "Regency" booster used in conjunction with a television set.

Increase the sensitivity of older model receivers and sets in the fringe areas by adding a modern television booster.

"NEW LAMPS FOR OLD," the cry of the disguised magician in that delightful fantasy, *Aladdin's Lamp,* can today be echoed with a similar cry—"New TV sets for Old." But unlike the story, today's magic change need not be wrought with trickery; all it needs is a good, honest booster based on some firm, solid facts.

Each year, in every progressive industry, some changes are made which tend to improve last year's product. Undeniably, the average 1953 television receiver is a more sensitive device than the sets of 1949, 1950, 1951, or 1952. The 1953 receiver also generates less internal noise than its predecessors and the combination of both these factors brings to the viewer a cleaner, more pleasing picture than he has had heretofore.

Now, you and I, and millions of other people, have television receivers which we bought in prior years and from which we still obtain a considerable amount of viewing pleasure. Perhaps our picture does not possess as much contrast as it could and perhaps it is spottier (with noise spots) than we care to have it. Still, this television set represents a substantial investment in many cases and few of us care to pay out more money for a new set when there is apparently so much "life" remaining in our present one.

So there's the dilemma. We would like to enjoy the benefits of the newest sets without being forced to spend a wad of money doing it. But can this be done?

The answer is *yes.* It can be done and at much less cost than most people would imagine.

Before we see how this can be done, let us determine what accounts for the somewhat poorer performance of the older television set. Assuming that your television set is operating normally and is not in need of repair, there are three factors which govern the quality of the picture you see. First, there is the amount of signal which your set is receiving from its antenna and obviously it cannot give you a full-blown picture from a half-baked signal. In other words, if you are not getting enough signal at the input, you cannot obtain a clear, rich looking picture on the screen.

Second, there is the sensitivity of your set. If your set is sensitive, it will require *less* signal to produce the picture you want than if it is not very sensitive. Sensitivity is something most of us are familiar with because it applies to radio sets in the same way it does to television receivers. A highly sensitive radio set will work almost anywhere in a house; a less sensitive unit will bring in the weaker stations only in certain parts of the house.

The third important factor that determines the quality of the picture you see is the amount of noise the set itself generates. This may be news to some readers, but every electronic network develops a certain amount of noise voltage. In a television system this noise can be particularly bothersome because it will travel along with the incoming video signal and appear in the picture. Now, if the received signal is strong, the noise spots (frequently called "snow") are "overpowered" and are not visible to the viewer. But if the signal is weak then in a noisy set the noise will predominate and completely ruin your picture. A noisy, spotty picture is a common sight in fringe or weak signal areas. But these are not the only places you see such pictures! Noisy, spotty pictures are *not* uncommon even in relatively strong signal areas. Sometimes it is the fault of the location; more often it is the set.

In a receiver, the noise that is developed by the first stage (the r.f. amplifier) is actually the most important because at this point in the system the level of the incoming signal is more nearly on a par with the receiver noise level than it is at any other point in the receiver. Whatever noise voltage is present at the input to the r.f. amplifier is amplified along with the signal and so, to obtain the best noise-free picture, we want to have as much signal and *as little noise* as possible at the front end of the set.

Now, of the three factors named, the amount of signal your set receives will not be considered further because we will assume that a competent technician installed your antenna and that you are picking up as much of the available signal as you can. That leaves set sensitivity and set noise and any improvement in these qualities will definitely improve the quality of your present picture.

Now, how can this be done? By installing a well-designed, well-constructed booster between the antenna and your set. But why a booster, you ask? Because a booster will, as its name suggests, boost the amplification of your set. Boosters are basically nothing more than r.f. amplifiers and when you attach one of them to your set, you are, in effect, adding one more r.f. amplifiers to the one already present in your television set. That a booster will raise the sensitivity of your present receiver, bringing it more in line with the newer sets and enabling you to obtain more contrast in your picture than you did before.

Sheer amplification, we have seen, is only half the story. Also to be considered is the existing noise factor

set. Here again a well-designed, -constructed booster can be of im- surable assistance. For if the e level of the booster is lower that of your set, it will add less e to the weak incoming signal. n, by the time the signal reaches set, it will have been amplified he booster and be in a much bet- position to override the receiver e.

short, by increasing the signal before it reaches your set, what- noise is present in your receiver be *less* effective than it is when ooster is present.

course, it is most important that booster itself have little noise, rwise you will gain nothing ex- a stronger signal with stronger e. But if the booster noise is low d it will be in a well designed —then the improvement in pic- quality will amaze you.

hat booster manufacturers recog- this situation is amply revealed the following excerpt from the ature of one such manufacturer. states, in part, that, "The noise of initial amplifier stages in the TV iver fixes the quality of reception. he noise factor is high, reception or. A good booster not only sup- the signal with sufficient r.f. gain overcome the noisy television r, but possesses a low noise fac- to furnish the best in reception."

hus, boosters are designed with aims in mind: To improve the al-to-noise ratio and to amplify weak incoming signal. Both fea- s are important and both are led. A booster capable of high but incapable of providing a signal-to-noise ratio will give a ure filled with disturbing noise s. A booster possessing a minimum nternal noise but capable of little will not amplify the signal suffi- tly to permit it to override the set e. So again the picture will be red with noise spots. Your booster t have both attributes or it might ell have none.

o show what improvement can be achieved with a good booster, consider the figures shown at the top of the chart of Table 1. Here we have the sensitivities of an average television receiver produced in each of three years, 1950, 1951, and 1952. For each year the table lists the minimum required amount of input signal for three low-band and three high-band channels. These facts provide us with a fairly complete picture not only on how the average receiver performed on various channels, but also how its performance varied from year to year. Thus, here is what we know:

1. In any given year, the set required less signal to produce a certain output on Channel 2 than on any other channel. In 1950, for example, an input of 566 microvolts was required to produce standard output at the picture tube. On Channel 4 we needed 636 microvolts to do the same thing; on Channel 6, 672 microvolts; and so on up until, at Channel 13, 1250 microvolts were required. Obviously, the set was less sensitive as the frequency increased.

2. In each succeeding year, sets became more sensitive; that is, they required less input signal to obtain the same output. Even so, it still took over 300 microvolts of signal on a 1952 receiver to give you what we might term a good picture on the high band (all other things being equal).

The data given in the lower part of Table 1 shows the improvement wrought by the addition of a booster to the receiver. Compare first the 1950 receiver performance with and without the booster. Without the booster your 1950 receiver is relatively insensitive compared to a 1952 model.

But look what happens when you add a booster! Not only does the combination sensitivity increase, but you actually require less signal than a 1952 receiver needs to produce the same picture. Here you have, by the relatively simple addition of a fairly inexpensive booster, improved the sensitivity of a 1950 set so that it exceeds that of the much newer 1952 set and this improvement is reflected on every channel. In many respects you get the benefits of 1952 set performance without expending the money needed to purchase a 1952 receiver.

WITHOUT BOOSTER			
CHANNEL	1950	1951	1952
2	566 μv.	425 μv.	150 μv.
4	636 μv.	496 μv.	175 μv.
6	672 μv.	530 μv.	200 μv.
7	1110 μv.	850 μv.	320 μv.
10	1170 μv.	955 μv.	320 μv.
13	1250 μv.	990 μv.	320 μv.
WITH BOOSTER			
CHANNEL	1950	1951	
2	113 μv.	85 μv.	
4	127 μv.	99 μv.	
6	134 μv.	106 μv.	
7	278 μv.	213 μv.	
10	293 μv.	241 μv.	
13	313 μv.	250 μv.	

Table 1. Comparison of receiver sensitivity with and without booster. Improvement in sensitivity of 1952 when booster was added is not shown as the improvement was slight.

WITHOUT BOOSTER			
CHANNEL	1950	1951	1952
2	11.5 db	9.5 db	6.5 db
4	12 db	10.5 db	7 db
6	13 db	10 db	7.5 db
7	15 db	14 db	10 db
10	15.5 db	14.5 db	10 db
13	15.5 db	15.5 db	10.5 db
WITH BOOSTER			
CHANNEL	1950	1951	1952
2	6.5 db	6.3 db	6.1 db
4	6.5 db	6.4 db	6.2 db
6	6.6 db	6.3 db	6.2 db
7	8.8 db	8.5 db	7.9 db
10	8.9 db	8.7 db	7.9 db
13	9.2 db	8.9 db	8.0 db

Table 2. Comparison of over-all noise figure with and without a booster in circuit.

What can be achieved with a 1950 set can, of course, be done with a 1951 set. Similar computations will show that the set of any year can have its sensitivity materially improved and this means that you can go as far back as the first postwar television receiver. As a matter of fact, the poorer the set sensitivity, the more marked the improvement when a booster is added as can be seen from Figs. 2 and 3.

Now let us consider the noise in

(*Continued on page* 212)

Fig. 2. Television picture with heavy noise interference.

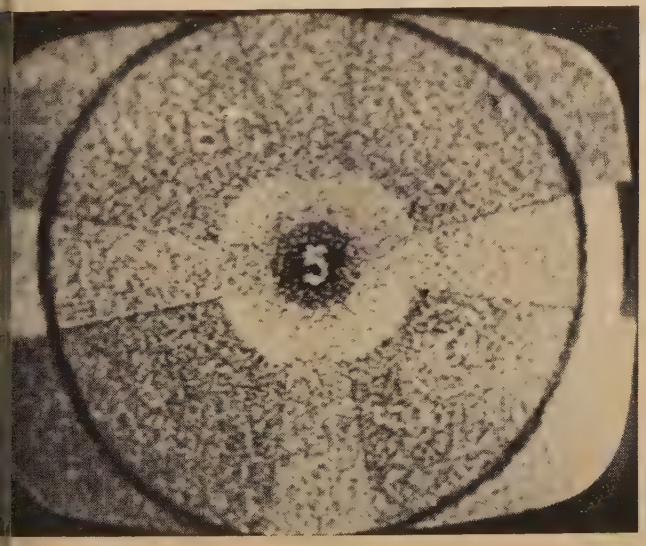
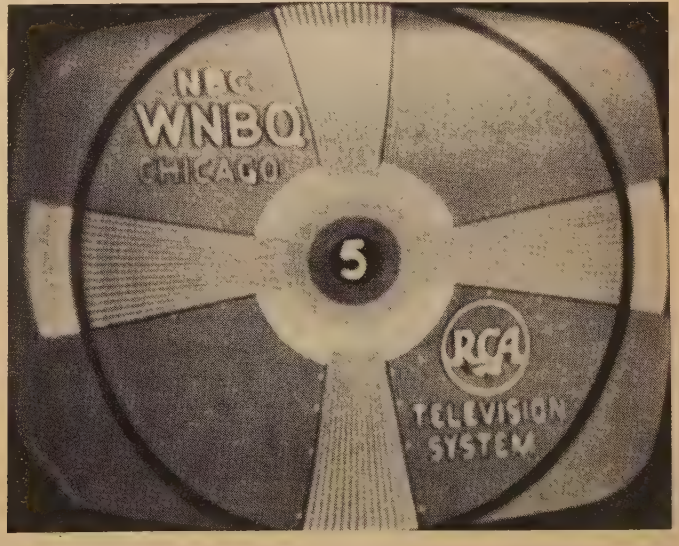


Fig. 3. Picture obtained after a booster was installed.



BRIGHTNESS CONTROL IN TV RECEIVERS

By **JOHN K. FRIEBORN**

Explains the operation of the various automatic brightness control circuits used in TV receivers.

STYLES in automatic brightness control have changed. The circuits used in most receivers today are different from those used in most receivers a few years ago. The methods now popular are not new; they were used in early postwar production, but by only a few manufacturers. On the other hand, the methods which used to be standard still are being used in some receivers.

The new styles are not merely different in detail from those which used to be popular; they use a basically different approach to the problem. Automatic brightness control in a television receiver is needed to keep the average picture brightness not constant, but natural. When the brightness of the scene being transmitted increases, the brightness of the picture at the receiver should increase. However, the transmitted video signal does not allow us to reproduce the average brightness directly, except by using direct coupling in the video amplifier. Even that solution presents special problems of its own and does not, by itself, completely solve the problem of automatic brightness control.

Fig. 1 shows a typical video signal waveform for two picture lines. The dashed lines represent average brightness of the respective lines. This average brightness varies irregularly from line to line, according to the scene being transmitted. The minimum brightness or black level occurs at definite times (during the parts of the blanking pulses before and after the sync pulses). The maximum brightness has an identifiable amplitude (at the video detector output it is the minimum signal amplitude). If we keep the minimum and maximum brightness correct, the average will be correct, provided that transmission and reception are linear.

There are several ways of keeping either the black level or the white level (maximum brightness) approximately constant. Most of them are based upon the idea of clamping some part of the signal. Clamping is, in effect, adding a slowly varying voltage, positive or negative, to the signal, so that the total voltage during the selected part of the signal always is approximately the same. The variations of the rest of the signal with respect to the clamped portion are preserved approximately as they were originally.

All of the old-style circuits are based on the idea of keeping the black level constant and practically all of them use sync pulse clamping. A simplified schematic of a typical circuit, the familiar diode d.c. re-inserter, is shown in Fig. 2. In this circuit, irrespective of the values of the a.c. and d.c. components of the signal at the plate of the video amplifier, the d.c. component produced by the varying charge on condenser *C* is just enough to place the picture tube grid at ground potential during the sync pulses. The blanking pulses make the grid somewhat positive. The picture tube cathode potential is adjusted by the brightness control so the blanking pulses bring the grid just up to cutoff, but not beyond. The peak value of the signal is adjusted by the contrast control to give the desired white level.

This method does not do everything required to keep the average brightness of the received picture natural under all conditions. It keeps the black level nearly constant, but the white level and average brightness vary with signal strength. To complete the job, we must have a.g.c. in the receiver to keep the peak video signal output from the video detector constant.

Another minor defect of this circuit, even with a.g.c., is that it does not compensate for variations in blanking to sync pulse ratio. Fixing the sync pulse and white levels will not fix the black level unless the blanking pulse is a constant fraction of the sync pulse amplitude. If the blanking pulse amplitude decreases after the brightness control is adjusted, the retrace lines may become visible. If it increases, some parts of the picture which are supposed to be gray will be black and indistinguishable from the parts which are rightly black.

According to FCC standards, the blanking pulse amplitude is 75% ± 2.5% of the sync pulse amplitude. If the station maintains this tolerance, sync pulse clamping keeps the blanking level at the grid of the picture tube constant within a volt or two and the variation is unnoticeable. The actual ratio in signals transmitted by certain stations in the past has varied from about 65% to 85%. This means a variation of ± 5 volts or more at the picture tube grid, which produces a noticeable effect. (See Fig. 3.)

The black level can be kept constant by blanking pulse clamping, used in a few *Sparton* and *Stromberg-Carlson* models. The basic circuit, in Fig. 4, is similar to the one in Fig. 2, except for the amplified negative sync pulse applied to the plate of the diode. Because of this pulse, the cathode of the diode is not negative with respect to the plate during sync pulses, so diode current cannot flow then. It does flow during the blanking pulses, the part of the video signal which makes the cathode most negative with respect to the plate. In the same way as the circuit in Fig. 2 clamps the sync pulses, this circuit clamps the blanking pulses to ground potential at the grid of the picture tube.

A different method of sync pulse clamping is shown in Fig. 5. In this method, the cathode and grid of a video amplifier tube are used the same way as the cathode and plate of the diode in Fig. 2. The positive sync pulses are clamped to ground potential at the video amplifier tube grid. A certain potential at the plate of the video amplifier tube corresponds to zero bias on the grid, depending upon the tube characteristics and other circuit components. Sync pulses are clamped to this potential at the video amplifier plate and the picture tube grid. The blanking pulses make the grid of the picture tube more positive the exact potential depending upon the video signal. The brightness control places the picture tube cathode at a potential positive enough with respect to the grid during the blanking pulse to cut off the beam current. The remarks made in connection with Fig. 2, about the effects of variations in peak signal amplitude and in blanking pulse to sync pulse ratio, also apply here.

eral other methods of sync pulse ing, including ones using sepa- riode or pentode tubes, can be in various receivers, both old ew.

old-style circuits we have been sing up to this point use either ng pulse clamping, which is only er name for black level clamp- sync pulse clamping, which is kimately the same. Most current ers use what might be called clamping for automatic bright- ontrol.

circuit of Fig. 6, used by rt-Warner, has grid-leak bias as he one in Fig. 5, but the phase signal at the grid of the video ier is opposite to that in Fig. 5. urrent flows not during the sync but during the parts of the signal corresponding to the est parts of the picture (the " parts). The white level is d to ground potential at the amplifier grid and to corre- ng potentials at the amplifier nd the picture tube cathode. blanking pulses make the pic- ube cathode more positive by ount depending upon the signal. id potential can be adjusted by ghtness control so the blanking just blank out the screen. A e in signal amplitude will cause ortions of the picture to become rk and make the retrace lines

matic gain control is even more ry in receivers having white ng than in those using sync clamping. Reference to Fig. 7 shes that for a given change in k value of the signal, the black hanges almost three times as when the white level is held t as when the sync pulses are d.

e clamping using grid leak bias picture tube is incorporated in rs made by *Emerson, General , Hallicrafters, Magnavox, Motorola, Philco, Stromberg-*, and *Zenith,* among others. shows a partial schematic of a used by *Magnavox.* When the gnal corresponding to a light the picture makes the picture thode more negative than the ectron flow from cathode to y rapidly makes terminal *A* of er *C* (and the picture tube) less negative. During the rest video signal, electron flow *R* to terminal *A* very slowly erminal *A* more negative with to terminal *B*. The white level e is clamped at the picture hode to a potential very slight- tive with respect to the grid rest of the signal makes the more positive.

brightness control is adjusted e the positive cathode bias and the picture brightness, the in- negative cathode potential he bright parts of the picture more grid current flow and id-leak bias, returning the pic- ture to its former brightness. This automatic increase of the grid-leak bias keeps too high a brightness control setting from pushing the light or medium gray portions of the picture up to the maximum brightness level. Too low a brightness control setting or too small a signal amplitude may keep the picture tube cathode from ever being driven negative with respect to the grid, so no grid-leak bias is produced and there is no automatic brightness control.

The term, "d.c. restoration," which often is used in discussions of automatic brightness control, suggests that an answer to the problem would be to use direct coupling in the video amplifier, so the d.c. component of the video signal would not be lost. Actually, direct coupling in the video amplifier has somewhat the same effect as white clamping. (See Fig. 9, the video amplifier circuit of *Arvin* chassis TE315-2.) In this circuit, the output of the video detector is most negative during the sync pulses, approximately 75% as negative during the blanking pulses, and approximately 10% as negative during the brightest parts of the picture. These voltages at the video am-

(*Continued on page* 193)

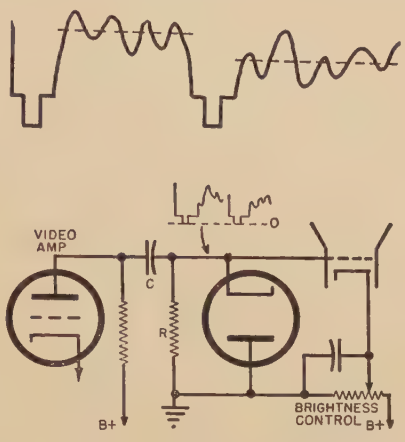


Fig. 2. Diode sync pulse clamping circuit.

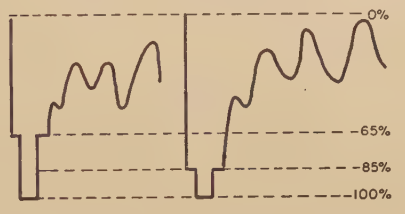


Fig. 3. Effect on black level of a change in blanking pulse amplitude percentage.

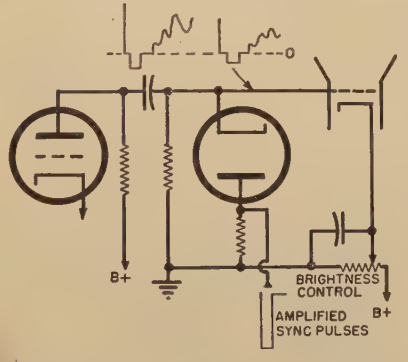


Fig. 4. Diode blanking pulse clamping.

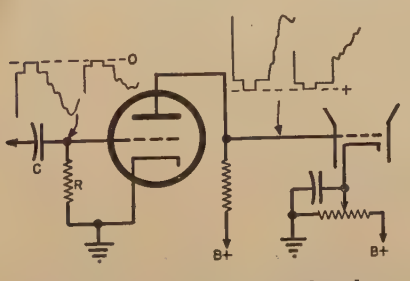


Fig. 5. Grid leak bias sync pulse clamping automatic brightness control circuit.

Fig. 1. Video signal for two picture lines showing the change in average brightness.

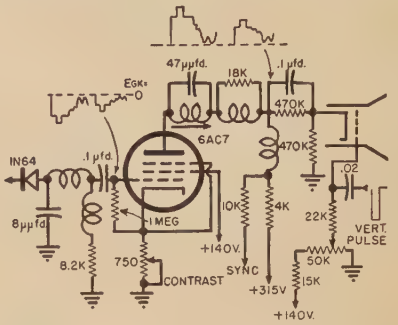


Fig. 6. White clamping type of automatic brightness control circuit used by Stewart Warner in their model 9202-C TV receiver.

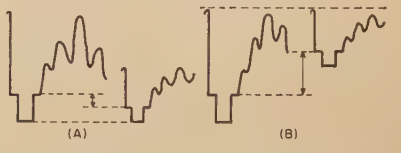


Fig. 7. Effect of a change in signal level on the black level for circuit using (A) sync pulse clamping; (B) white clamping.

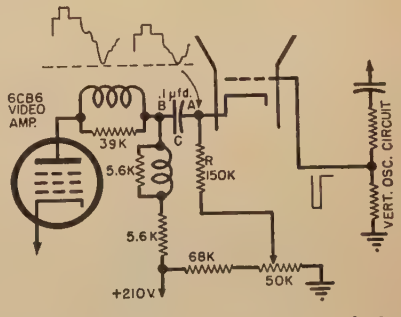


Fig. 8. Automatic brightness control circuit of the Magnavox 104 series sets.

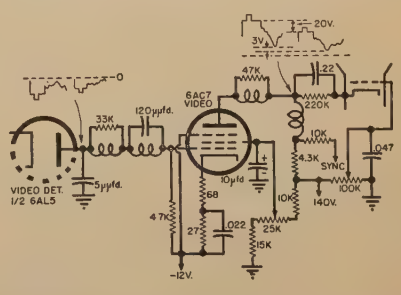
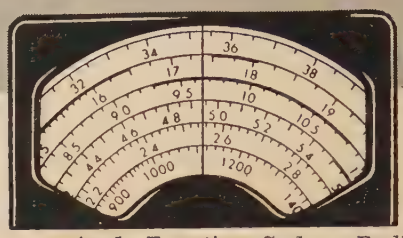


Fig. 9. Arvin's white clamping circuit.

International SHORT-WAVE



Compiled by KENNETH R. BOORD

ARNE SKOOG, DX Editor, *Radio Sweden,* tells me that the "Short Wave Game" (contest) sponsored by Teknikens Varld, Stockholm, last March was a great success with 1451 contestants. Participating stations numbered 24 from all parts of the globe. "The aim of promoting interest in short-wave listening was obviously reached, and our radio club has enrolled 2000 new members during the past few months, making a total of more than 15,000 members as of July," Skoog explains. It is planned to make this "Radio Game" an annual affair—with the 1954 competition set for the Easter weekend.

* * *

DX Program

Tentative plans have been made for your *ISW DEPARTMENT* editor to play a program of Christmas organ melodies, by tape transcription, in a special DX broadcast from HCJB, Quito, Ecuador, on Thursday, December 17 at 0330 (0830 *GMT*) with beam to Europe on 15.115, 11.915, 9.745; *repeated* 1600 (2100 *GMT*) with beam to the South Pacific on 17.890, 15.115, 11.915.

By that time, the move of transmitters to Pifo should have been completed, and reception reports will be especially welcomed. HCJB verifies *correct* reports 100 per-cent; *an IRC is appreciated but is not required. More details next month.*

* * *

This Month's Schedules

(*Note*: Some stations may have reverted to *winter* schedules and/or frequencies between the time this was compiled and now; in such cases, you may find some schedules *one hour later* than listed herein.—K.R.B.)

Afghanistan—Kabul Radio, 9.975A, is heard in Sweden 1140-1205 in *English;* starts with Eastern music, has news 1150, and Western music 1155; CWQRM. (Arvidsson)

Alaska—ALF, 5.260, Juneau, heard *testing* 0100; will QSL from Box 380. (Cain, Nevada) *Better include return postage with report.*

Algeria—Radio Algerie, 6.165, was noted 1830 with Eastern music; closed 1930 with "La Marsellaise." (Ferguson, N. C.)

(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.) The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

Fourteen-year-old Bill Crowell, Harrisburg, Pa., now a monitor for RADIO & TELEVISION NEWS, became interested in short-wave listening as a result of the first "Boys' Life" Radio Listening Contest ("Boys' Life" is the official publication of the Boy Scouts of America). While he didn't do so well in the competition, Bill says he has found many hours of fun and excitement in pulling in distant stations and in receiving QSL cards and letters from the stations logged. He has logged 56 foreign countries. Bill types out his log sheets and puts them on the wall over his receiver for ready reference.

Anglo-Egyptian Sudan—Radio C durman now uses 6.438 and 7.664; *English* on Fri. 1230-1300, Sun., W at 1115. (Radio Sweden, others) He near 7.655 in Arabic at 1240 tune (Pearce, England)

Angola — Luanda, 11.862, is g strength in Sweden 1400-1430; *bef* and *after* that time has QRM fr BBC. (Arvidsson)

Argentina—Radio Splendid has g level 1630 on 9.320A; *Radio Belgra* 9.76, is fair signal 1700, and *Radio Mundo,* LRX1, 6.120, is heard w news in Spanish by woman 1700. (rentzson, Sweden)

Australia—VLC9, 9.615, is now u to Eastern North America 0700-08 to Western North America 1015-11 DX session Sun. 0830. (Belling N. Y., others) VLA15, 15.200, is ex lent around 2155-2315 to West Co (Bates, Calif.; Dannenfelzer, M VLC9, 9.615, is a satisfactory sig in Minn. around 0830. (Peters And in West Coast session 1015-1 (Smits, Minn.) VLB9, 9.58, noted w music 0725. (Frazier, Texas)

Austria — Blue Danube Netwo Salzburg, now lists channels of 9. 5.080, 6.055. (Pearce, England, othe

Azores—CSA93, 4.865, Ponta D gada, noted closing 1800 with "A P tuguesa," weak level in Denma

Belgian Congo—OTC, 9.655, Leop ville, is excellent with *English* re from ORU, Brussels, Belgium, 2(2200 closedown. (Kirby, Mo.; Zer Pa., others)

Belgium—ORU4, 9.767, is good le to USA-Canada 1930-2200; *Eng* from 2000. (Kubachi, Mass.; Dann felter, Md., others)

Bolivia—CP38, La Paz, lists curr frequency as 9.444 on the air S 0755-0900, 0700-1600; weekdays 0 0815, 1030-1330, 1855-2200. (Bell ton, N. Y.) On a recent check, h ever, seemed to be still on 9.497.7 2000 where had bad QRM. (S Texas)

Brazil—ZYC8, 9.610, *Radio Tau* is heard as early as 1600 at good l but with some QRM from c.w. tions. (Gade-Joergensen, Denm PRK9, 15.190, noted with music 1650. (Arvidsson, Sweden) P 9.72, Rio de Janeiro, noted with sical program 2200, with *English* Portuguese announcements. (C Iowa) *Radio Record,* Sao Paul been noted dual on 9.505, 11 around 1830.

(*Continued on page* 128)

THE OARAC

By
BERNARD H. GEYER
Electronics Laboratory, General Electric Co., Syracuse, New York

Capable of solving 1011 simultaneous equations, this ingenious calculating machine speeds operations for the U.S. Air Force.

HE OARAC (Office of Air Research Automatic Calculator) is an electronic calculating machine (illustrated on this month's cover) designed built for the U.S. Air Force by *General Electric Company*. It is able of solving the most complex thematical problems at speeds ch seem fantastic to those not acinted with the principles of elecnics.

t may be said that OARAC has a 00 word memory with an average ess time of 9 milliseconds, that it multiply two ten-digit numbers in roximately 8 milliseconds, that it add two such numbers in less n 100 microseconds, and that it perform as many as 100 arithmeoperations per second. It might, vever, be more informative to look this 1400 tube electronic giant h the eyes of a layman who has er heard of a 10,000 word memory a 9 millisecond access time.

ne of the first things to come to attention of our hypothetical layn would be the OARAC memory. is part of the computer (some call he "brain" or "heart" of the mane though that is hardly justified) ters around an aluminum cylinder in diameter and 30" long. This nder rotates at a speed of 3350 n and is coated with a magnetic de similar to that found on the es used in magnetic tape recorders. proximately 200 magnetic recordyback heads are spaced along the s of the cylinder approximately 02" from its surface. When a posie or negative electrical pulse is plied to one of these heads the gnetic surface of the cylinder imdiately adjacent to the head is gnetized to form a positive or negve magnetic spot. Each of the 200 ds can write 2600 such spots around circumference of the cylinder. That a total of 200 x 2600 = 520,000 spots! e same head reads back a positive negative electrical signal whenever of the magnetic spots passes beth it. Thus it may be seen that e a spot has been recorded on the nder it is available to be read k once each drum revolution thereer.

n the language of electronic comers, each of these 520,000 magnetic ts represents one "bit" (binary it) of information. In the OARAC, group of 52 bits is called a word ce, hence it may be seen that the RAC memory contains 10,000 word ces. Thus we say that OARAC has 0,000 word memory.

Since each spot on the memory cy-

(*Continued on page* 180)

HOW THE DIGITAL COMPUTER SOLVES A PROBLEM

OARAC is a large-scale digital computer with an extra-large memory. It can solve 1011 simultaneous equations. The simple illustration that follows will give you an idea of how the computer operates. Actually, the equation used might only be one thousandth part of a highly complicated problem.

In the equation—

$$y = 3x^2 + 5x + 2 = [3x + 5]x + 2$$

find y for all values of x between 1 and 1000 in steps of one.

The following information is stored at addresses in the computer's memory—a rotating magnetic drum:

Address	Number	Line	Address	Instruction Operation	Instruction Address
0000	x = 1	1	1201	21	0000
0001	999	2	1201	24	0003
0002	1	3	1203	22	0004
0003	3	4	1204	24	0000
0004	5	5	1205	22	0005
0005	2	6	1206	12	0006
0006	y	7	1207	31	0006
		8	1208	21	0001
Key to Instructions					
21 = put into accumulator		9	1209	23	0000
22 = add		10	1210	30	1215
23 = subtract					
24 = multiply		11	1211	21	0000
30 = choice (see further)					
31 = read to tape		12	1212	22	0002
32 = go back to					
12 = write into memory		13	1213	12	0000
34 = stop and ring bell					
		14	1214	32	1201
		15	1215	34	0000

By turning a knob and pushing buttons on OARAC's front panel, the operator tells it to go to address 1201 and perform operation 1. It automatically proceeds from there to operation 2, 3, 4, and so on, performing the operations as follows—

Line Number	Operation
1	"Bring what is at address 0000 into the accumulator." At this address the number 1 is stored. (x=1)
2	"Multiply the number in the accumulator by 3." Result: 3x=3
3	"Add to what is in the accumulator, the number at 0004." Result: 3x+5=8
4	"Multiply result of operation three by value at 0000." Result: (3x+5)x=8
5	"Add what is in 0005." Result: (3x+5)x+2=10=y
6	"Put answer at address 0006 on the magnetic drum."
7	"Record answer on magnetic tape for future printing."
8	"Put into accumulator the number at address 0001."
9	"Subtract x from that number." Result: (999—x)
10	"Make a choice . . . if (999—x) is positive or zero, continue with operations 11, 12, and so on; otherwise perform operation 15, ringing bell to indicate problem is finished."
11	"Put x into accumulator."
12	"Add 1, giving (x+1), the new value of x."
13	"Record this at address 0000, making the new value of x available for calculating y."
14	"Go back to operation 1 at address 1201."

From here on, the computer repeats steps 1 through 14 until x reaches 1000. Then operation 10 stops the calculation and rings bell to signal operator his instructions have been carried out.

The Con-VI

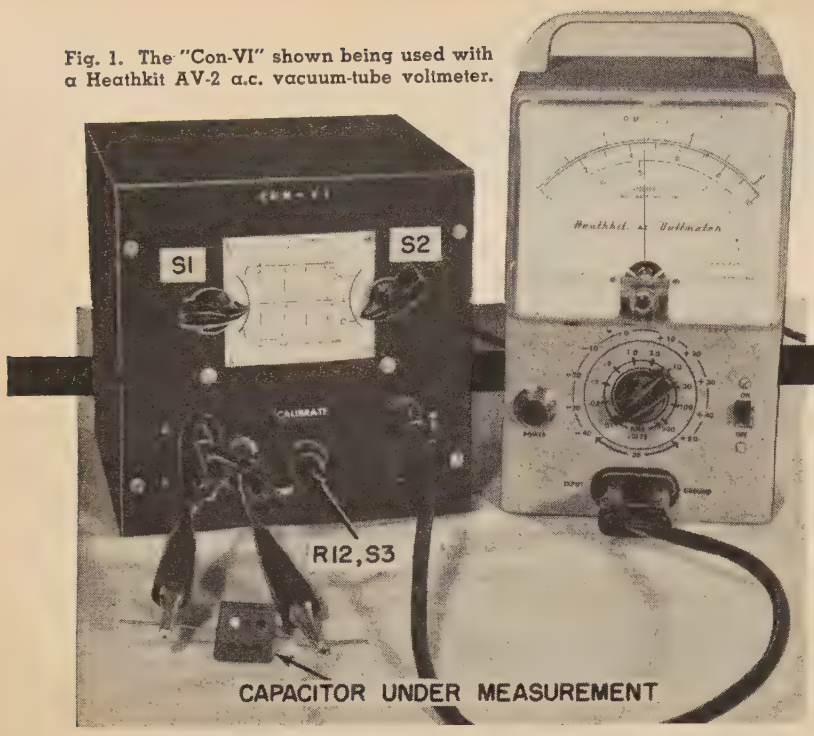


Fig. 1. The "Con-VI" shown being used with a Heathkit AV-2 a.c. vacuum-tube voltmeter.

By **RICHARD GRAHAM**

Used in conjunction with an a.c. vacuum-tube voltmeter, this device permits direct reading of a wide range of L and C.

SOME device for measuring inductance and capacitance is, of course, a necessity in any well equipped lab or shop. In places where "time is money" the speed with which the answer is obtained means dollars—perhaps in servicing jobs completed or engineering hours gained. But we've become so accustomed to thinking that only bridge type instruments are used for *LC* measurement that we are prone to forget that there is more than one way to "skin a cat."

The method described in this article utilizes a constant current and voltage source and an a.c. vacuum-tube voltmeter. The conditions of test are such that the value of unknown capacitance or inductance can be read directly on the scales of the v.t.v.m. Thus, this method features speed and convenience with fairly good accuracy. The full scale readings range from 10 millihenrys to 300 henrys, and 100 micromicrofarads to 3 microfarads. Furthermore there is no adjusting and juggling of any null or balance controls. This method, while not new, is worthy of review by busy service shops and labs and is ideal for a host of other production and industrial applications.

Basically the instrument is quite simple. It consists of an audio oscillator which will operate on three specific frequencies (more about this later), a power amplifier, and a power supply. The output of the power amplifier is either in series with a low resistance or a very high resistance, thus converting the oscillator into either a constant voltage or constant current generator. This rather lengthy and awkward sounding title for the device to be described can be abbreviated somewhat. Let's refer to the unit as the "Con-VI" from here on in.

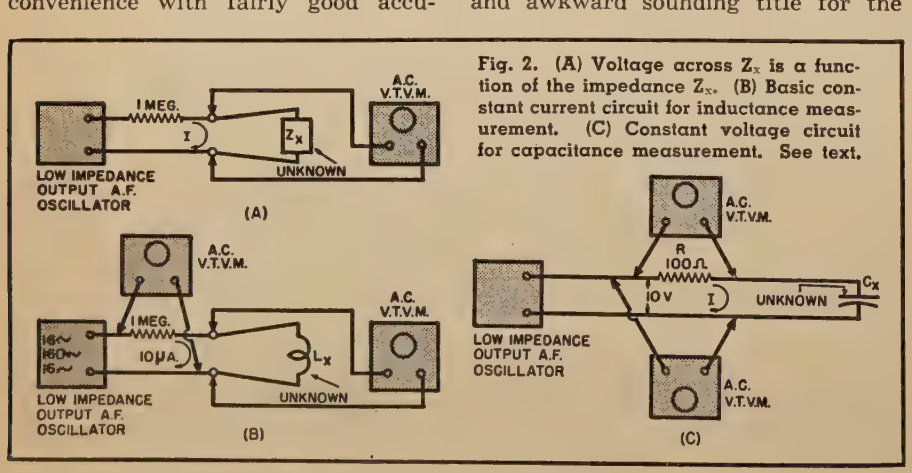


Fig. 2. (A) Voltage across Z_x is a function of the impedance Z_x. (B) Basic constant current circuit for inductance measurement. (C) Constant voltage circuit for capacitance measurement. See text.

Principles of Operation

Whenever an unknown impedance, *Z*, is placed across a high impedance source, the voltage across the impedance *Z* is a function of the value of that impedance. The high impedance source can be devised simply by placing a high resistance in series with the output of an audio oscillator. This is illustrated in Fig. 2A.

If the value of the unknown impedance, *Z*, is small in comparison with the internal impedance of the generator (which in this case is substantially 1 megohm) then the generator can be considered to be a constant-current source. Thus as long as the value of the unknown impedance, *Z*, is substantially smaller than 1 megohm, the current, *I*, flowing is always substantially the same. If this is so then the voltage read on the v.t.v.m. of Fig. 2A is directly proportional to the value of the impedance *Z*.

Now, if an inductance, *L*, is placed across the output terminals of a constant current source, we note that the voltage appearing across the inductance is:

$$X = E/I = 2\pi fL$$
$$E = 2\pi fIL$$

If the significant value of the voltage, as read on the v.t.v.m., is to be the same as the significant figure of the inductance, the $2\pi fI$ has to be made some power of 10. This can be easily accomplished by adjusting the output of the oscillator as shown in Fig. 2 to 10 volts. The current, *I*, flowing will then be 10 microamperes. Now by choosing an oscillator frequency or some multiple or sub-multiple of 159 the $2\pi f$ in the equation also becomes a power of 10. The significant figure of the voltage across the inductance of Fig. 2A is now the same as the significant value of the inductance. The circuit shown in Fig. 2A is basically the same as that used in the "Con-VI" when measuring inductance.

A condenser could be measured the constant current setup just

d, however the condenser value never be read directly off the of the v.t.v.m. A conversion would be necessary. This is be- the reactance of a condenser is sely proportional to the voltage s it. A large meter reading d indicate a small capacitance *vice versa*. By using a constant ge circuit, as shown in Fig. 2C, nsers can also be read directly e meter scale.

Fig. 2C, the current flowing is ly proportional to the value of nser C_x. If there is no capaci- present, there will be no cur- flowing, and *vice versa*. This can pressed more rigorously by the ving:

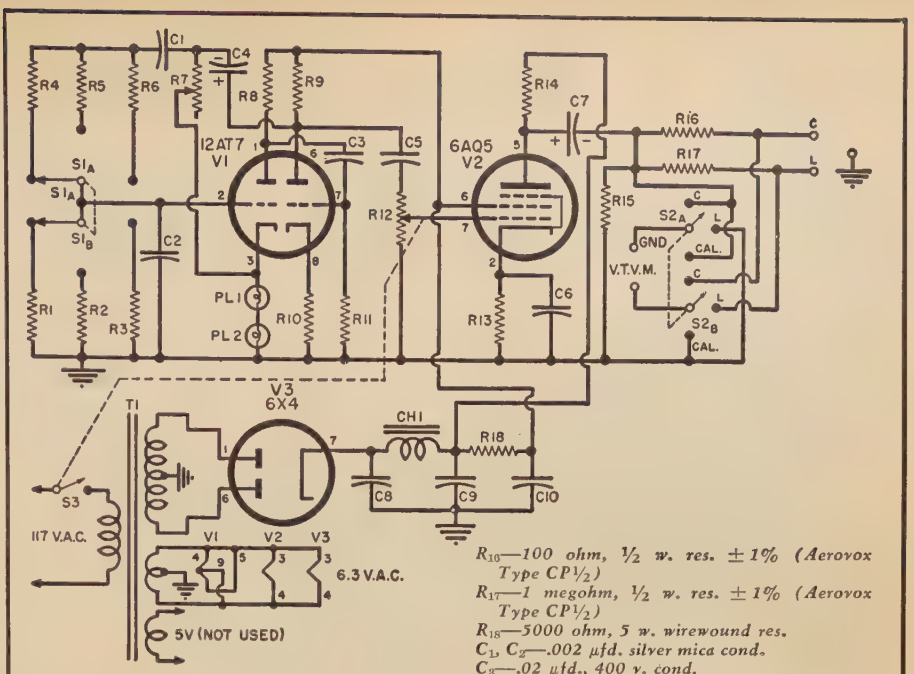
$$X = E/I = 1/(2\pi fC)$$

fore: $I = (E)\ (2\pi fC)$

current can be determined by uring the voltage drop across a hm precision resistor, R, in series condenser C_x.

e again by making the value of in the above expression a power the v.t.v.m. can be made direct ng. This condition is satisfied by g the generator output voltage ual 10 volts, and making f a mul- of 1592 as before.

r example to make the meter 100 $\mu\mu$fd. full scale, a voltage of olts with a frequency of 16,000 s will cause a current of 100 mi- mperes to flow. This current ng through a 100 ohm precision or means that the meter when d on the .01 volt scale will read μfd. full scale.



R_1, R_4—*5 megohm, ½ w. res. ± 1% (Aerovox Type CP½)*
R_2, R_5—*500,000 ohm, ½ w. res. ± 1% (Aerovox Type CP½)*
R_3, R_6—*5000 ohm, ½ w. res. ± 1% (Aerovox Type CP½)*
R_7—*10,000 ohm pot. (Centralab B-14)*
R_8—*50,000 ohm, ½ w. res.*
R_9—*20,000 ohm, ½ w. res.*
R_{10}—*1000 ohm, ½ w. res.*
R_{11}—*1 megohm, ½ w. res.*
R_{12}—*500,000 ohm pot. (Centralab B-59-S)*
R_{13}—*200 ohm, ½ w. res.*
R_{14}—*500 ohm, ¼ w. res.*
R_{15}—*470,000 ohm, ½ w. res.*
R_{16}—*100 ohm, ½ w. res. ± 1% (Aerovox Type CP½)*
R_{17}—*1 megohm, ½ w. res. ± 1% (Aerovox Type CP½)*
R_{18}—*5000 ohm, 5 w. wirewound res.*
C_1, C_2—*.002 µfd. silver mica cond.*
C_3—*.02 µfd., 400 v. cond.*
C_4, C_7—*24 µfd., 350 v. elec. cond. (Aerovox Type PRS)*
C_5—*.1 µfd., 400 v. cond.*
C_6—*25 µfd., 25 v. elec. cond.*
C_8, C_9, C_{10}—*20/20/20 µfd., 450 v. elec. cond.*
T_1—*Power trans. 240-0-240 v. @ 50 ma.; 6 v. @ 2 amps. (Stancor PC-8402 or equiv.)*
CH_1—*7 hy., 50 ma. filter choke (Stancor C1707)*
PL_1, PL_2—*3 w., 117 v. pilot lamp*
S_1, S_2—*D.p. 3-pos. switch (Centralab 1404)*
S_3—*S.p.s.t. sw. (on R_{12})*
V_1—*12AT7 tube*
V_2—*6AQ5 tube*
V_3—*6X4 tube*

Fig. 3. Complete schematic diagram and parts list for the "Con-VI."

Circuit

of the functions shown in Figs. nd 2C have been combined into one unit to make up the "Con-VI." The schematic diagram of this unit is shown in Fig. 3.

A single 12AT7 serves as a Wien bridge oscillator which can be switched

(*Continued on page* 162)

g. 4. Top chassis view of the "Con-VI" showing parts layout.

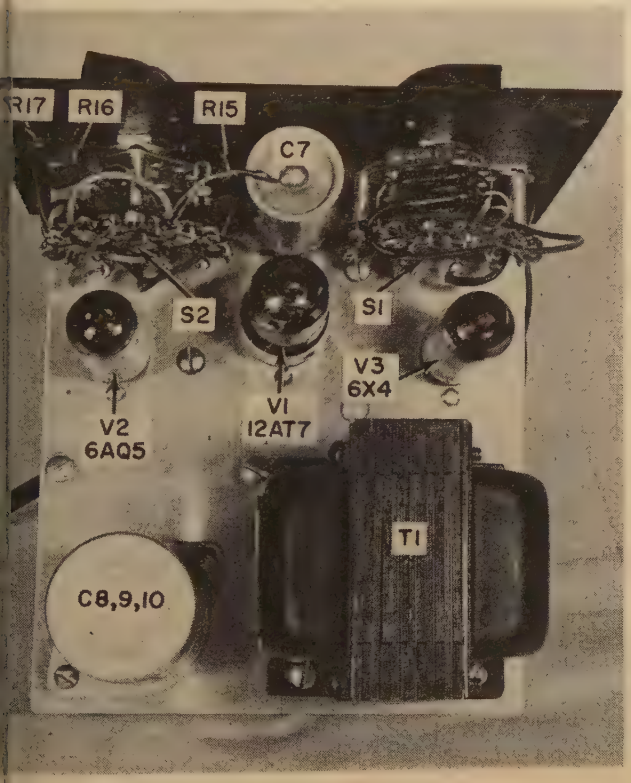
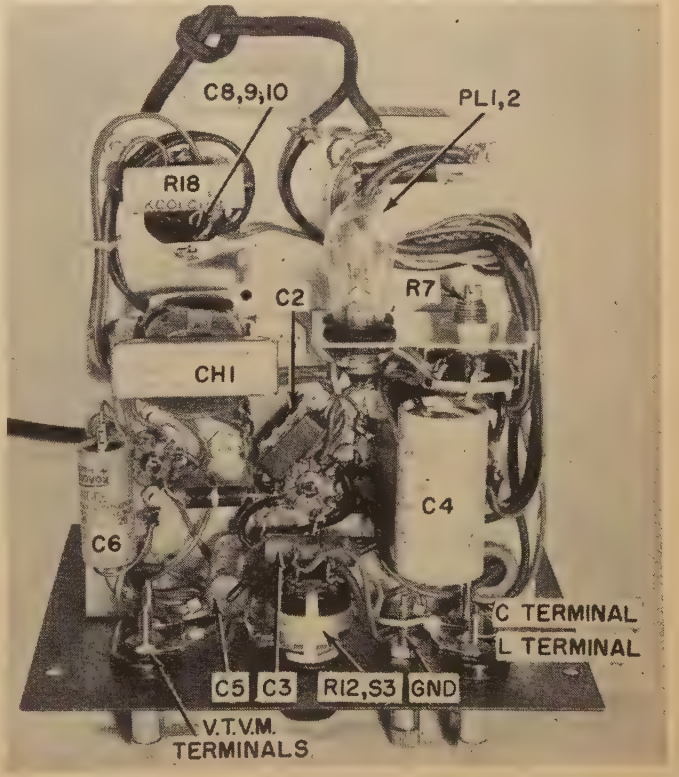


Fig. 5. Under chassis view of unit with major parts identified.



MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE

THE NOT-SO-SIMPLE SETS

"MIDGET DAY" was what Barney termed it. He was referring to the fact that every set slated for repair that day was of the small a.c.-d.c. variety, and the youth was looking forward to a pleasant afternoon of "turning 'em out like hotcakes," as he put it.

However Mac, his boss, noticed that the boy seemed to be taking an unconscionably long time to cook the first hotcake. In fact, after probing and snipping and soldering on the small chassis for nearly an hour, he was looking more puzzled and exasperated every minute.

"Surely an electronic engineer of your caliber can't be having trouble with a simple midget set," Mac taunted him.

"Simple my eye" Barney exploded. "This thing is about as simple as Sanskrit. It don't make sense. When you first turn it on, you can barely hear the local station; but the longer it runs, the better it gets. After it has been on twenty minutes or so, the sensitivity and volume gradually improve to where you can pick up several out-of-town stations, although the receiver is still not as hot as it should be."

"And what kind of a message do you get from these symptoms?" Mac asked with a quizzical grin.

"First I decided it must be a tube with low emission that took a long time to get hot enough to put out; so I changed all the tubes—but that was the only thing that changed. Next I concluded that perhaps an i.f. transformer had a defect so it was out of line when cold and sort of drifted in as the set warmed up, but that was a bum steer, too. I got to thinking perhaps there was a plate or screen-dropping resistor that had a real high resistance when cold but came down to somewhere near normal when warm, but a careful check with the ohmmeter proved that hunch was no good. The 'B-plus' voltage is around seventy-five or eighty volts, which is a little low but not low enough to account for the deadness of the set when you first turn it on. That brings you up-to-date on my thinking. No reasonable suggestion from those present will be ignored."

Mac pulled down the service manual that contained the diagram of the set and took a long look at it. Then he asked mildly, "Have you looked at this?"

"Who needs to look at diagrams of a.c.-d.c. receivers?" Barney scoffed. "I can draw every one of them with my eyes shut and recite 'The Shooting of Dan McGrew' backwards while I'm doing it."

Mac did not argue, but he took a small electrolytic condenser from a drawer and bridged it across one of the condensers in the little set. Immediately the volume increased at least four-fold, and the receiver acquired that between-stations hiss that goes along with good sensitivity.

"Let me have a gander at that diagram that tells you so much," Barney muttered as he reached for the service manual. After glancing at it for only a minute he looked up with a sheepish grin. "Now I get it," he said. "That dog uses a voltage-doubling rectifier, and where I was measuring 75 volts I should have been getting 190. One of the current-storing condensers is about gone. When cold, it has practically no capacity; but as it warms up it does achieve a microfarad or so, and then the voltage goes up and gives the set more pep. And before you say it," he hurried on as Mac opened his mouth, "I *know* I should have turned to the circuit diagram when I first began to feel stumped, as you so often have told me to do."

"I might as well have saved my breath to cool solder joints," Mac complained. "Your trouble is that you are always letting what you think you know get in the way of a real chance to learn. Don't ever sell these little sets short when it comes to giving you headaches. Many of them use almost identical circuits, but that just lulls you into a condition where the occasional different circuit can waste a lot of time.

"That set I just finished was a good example. It would play fine for a few minutes, and then the volume would slowly fade away. I shucked it out of the cabinet so I could get a good look at it, and then I noticed that just before the volume started to fade some of the tubes lighted very brightly while a couple of them became very dim."

"Doesn't sound so tough," Barney broke in. "Probably one of the heaters was shorting through a cathode to ground and cutting heater current off the tubes that went dim. Since the voltage that used to be divided among all the heaters was now across only a part of them, these heaters naturally got brighter."

"That makes me wonder if I'm starting to slip," Mac replied, "for my first thoughts followed exactly along the same channel as yours. Ignoring the obvious fact that if a short of that nature was occurring the tubes without heater current would have gone clear out instead of just growing dim, I replaced all tubes that either grew brighter or dimmer. When this made no difference, I looked at the diagram and found out the two dimming tubes had 300 ma. heaters while the remaining 150 ma. tubes were arranged in two parallel strings in series with the 300 ma. jobs.

"Normally this arrangement gave each tube its proper heater current, but now one of the 150 ma. heaters was intermittently opening. When it did, it left only one 150 ma. string in series with the 300 ma. tubes. This meant that the current through the smaller heaters was greatly in excess of what it should be for them, but at the same time this current was inadequate to light the 300 ma. heaters to normal temperature. It so happened that the tubes in the string that was cutting on and off had very dark bulbs that hid this action from sight. This is the first time in a long, long time I have run across this deal in a radio although it is pretty common in TV sets."

While Mac was talking Barney had replaced all the filter condensers in the set he had been working on and had located an output transformer with an open primary in an overgrown table model. He quickly

(*Continued on page* 192)

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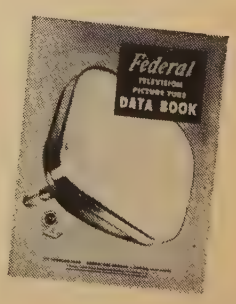


TRANSISTOR POWER SUPPLY

By LOUIS D. CARCANO

A VARIABLE-VOLTAGE power supp is highly desirable when experimer ing with transistor circuits. Sometim transistor circuits are critical as to vo age. Whether or not a given circuit critical, is an important thing to find ou Moreover, the first step in finding o whether a particular circuit is operab is to try varying the supply voltage.

The circuit illustrated is simple ar compact. Because the current drain small and good regulation is not r quired, it is feasible to use a potentio eter R_2 to vary the a.c. voltage to t power transformer. The bulkiest ar most expensive component, a "Varia or similar variable transformer, is th eliminated. The power transformer is small unit having a 117-volt seconda rated at about 20 ma., as well as a 6. volt secondary. The latter winding is n used. These small transformers a available as replacement types for T boosters, and also on the commercial su plus market. A small selenium rectifi and an RC filter complete the supp Hum is less than 2 millivolts. Maximu output is 40 volts, 5 milliamperes.

Metering of both voltage and load c rent is very desirable. A single me with a switch may be used, but separ meters are better.

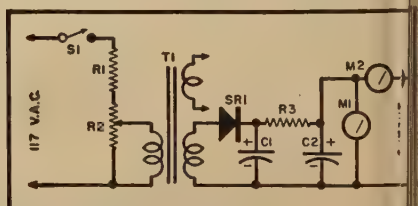
When operating an unfamiliar tran tor circuit, always make sure that th is enough resistance in series with t emitter circuit to limit the current to t rated maximum (usually 3 ma.) or ld Keep a current-limiting resistor in ser with the collector supply too. Before moving the resistance, make sure t reducing the resistance does not ma the current rise rapidly.

Always start out with the supply vo age turned down to zero, and after c necting the transistor circuit to the s ply, raise the voltage cautiously, keep an eagle eye on the current meter.

Never connect a doubtful transis circuit to a power supply of this sort less the voltmeter reads zero. If the c rent drawn by the circuit should h any tendency to "run away," the tran tor could be burned out by the cha stored in the filter condensers.

Most of the newer circuits for junct transistors require only a single po supply or battery. Where a groun base circuit needs a separate emi source, a single flashlight cell is usu all that is needed in addition to the po supply described here.

An inexpensive variable power supply use with experimental transistor circu



R_1—3300 ohm, 2 w. res.
R_2—2000 ohm, 2 w. vol. control
R_3—3300 ohm, ½ w. res.
C_1, C_2—50 µfd., 50 v. elec. cond.
SR_1—25 ma. selenium rectifier
T_1—TV booster-type power trans. with 11 sec.
M_1—0-50 volt meter
M_2—0-5 ma. meter
S_1—S.p.s.t. switch

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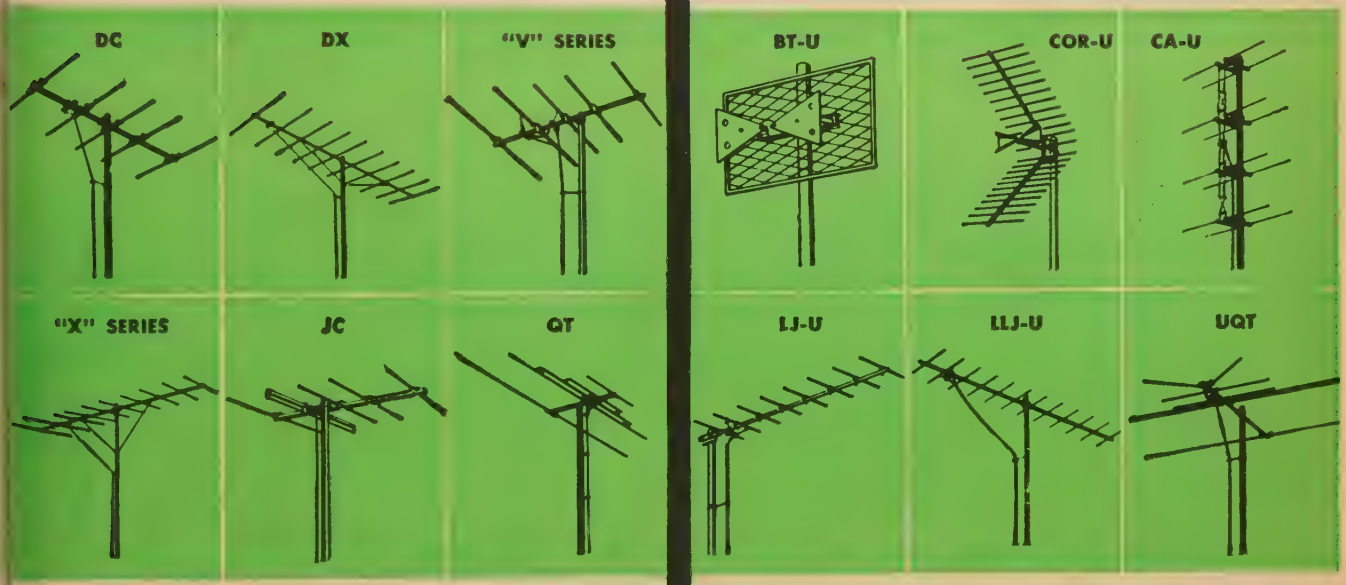

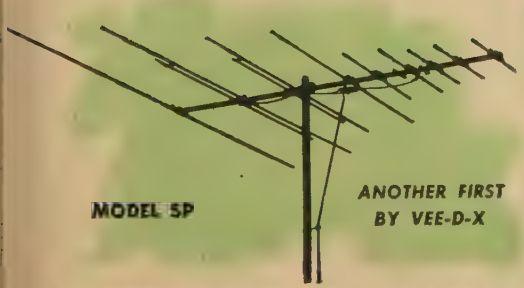

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HIGH-FIDELITY WITH CRYSTAL HEADPHONES

By **CHARLES E. COHN**

Use these relatively inexpensive phones to provide hi-fi listening, record monitoring, or for private hearing.

CRYSTAL headphones of the high-fidelity type are capable of giving quality comparable to that obtained from the best amplifier-speaker systems. For this reason, they are useful for low-cost, high-fidelity listening, for recording monitoring, or for listening without disturbing others. However, this quality is not obtainable without certain precautions which will be explained here.

The manufacturer's literature accompanying crystal headphones states that they may be connected into any tube circuit without affecting the frequency response. However, this is not quite true, as the impedance of these phones is capacitive and thus decreases with frequency. For example, the *Brush* BA-209 single phone (one unit of the BA-206 headset) has an impedance of 100,000 ohms at 1000 cycles and 10,000 ohms at 10,000 cycles. These specifications may be considered typical of all crystal phones. When these phones are bought as double headsets, they are connected in parallel, which means that the impedance of the headset will be 50,000 ohms at 1 kc. and 5000 ohms at 10 kc. Since these phones are flat across the greater part of the audio range with a constant voltage input, it is clear that these impedance characteristics will cause a considerable degradation of treble response if the phones are connected to a circuit having a high output impedance. For example, if this headset were driven by a pentode, its response would be 20 db down at 10 kc., with a high-mu triode it would be about 17 db down, while with a medium-mu triode it would be about 8 db down. This is clearly unacceptable performance, and shows that, despite the manufacturer's statements, these phones *cannot* be connected to just any circuit with acceptable results.

The ideal solution to this problem is to drive these phones with a cathode follower, but if the extra tube for this purpose is undesirable a compromise can be made. This can be done by replacing the original phone cord with a standard replacement cord, which would connect the phones in series instead of in parallel. Thus the impedances would be 200,000 ohms at 1 kc. and 20,000 ohms at 10 kc. This is still unacceptable for a pentode or high-mu triode, but with a medium-mu triode will cause a drop of only 3 db at 10 kc., which is not too bad, and can possibly be compensated for by tone control adjustment or altering the de-emphasis network if the phones are used with an FM set. The 6 d loss in audio volume caused by th series connection is, of course, unim portant if the system has any reserv gain, as it should have.

The circuit which the manufacture recommends for headphone connecti is shown in the accompanying dia gram. The value of the blocking co denser is not especially critical, but should be of high quality in order prevent damage to the phones throug d.c. leakage. The 1 megohm resist across the phones does not affect th response, but serves to prevent te large d.c. voltages from being bui up across the phones in case of slig condenser leakage. The manufactur states that this resistor can be r placed with a volume control, b from the above discussion it is cle that such is not advisable, as it wou lead to a great loss of treble with t volume control turned down.

Audio levels required for normal l tening are about 3 volts for the para lel connection and about 6 for t series connection. Plenty of outp should be available, as high-fideli listening requires lots of volum These phones can handle any outp which the ear can stand.

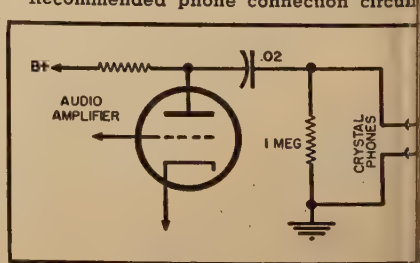
In this article the author h tried to show how crystal phon can be used to provide fidelity co parable to the best presently ava able. This information should be particular interest to the high-fid ity fan with limited resources, as pair of these phones and an F tuner can give him much listen ing pleasure while he saves up to b a good amplifier and speaker. Oth cases where these phones would pro useful are if there is no room for satisfactory speaker enclosure, or the high volume which high-fidel fans like would cause trouble with family or the neighbors.

REFERENCE

"*New High Quality Headphone Receiv* Brush Strokes, *September 1952 (Brush velopment Company)*

—30—

Recommended phone connection circui



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"LPRS" Preamp Control

(*Continued from page 75*)

compact, inexpensive, single-circuit selector switch. Long input cables can be used with magnetic pickups because of their low terminating resistors and with high-level inputs if the voltage dividers (or at least the series elements of the voltage dividers) are placed at the signal sources, since the lines then operate at low impedance. Crystal pickups can either be fed into voltage divider inputs, the tone controls being set more or less flat, or they may be fed into 15,000 ohm loads as recommended by Charles Boegli ("A Preamp for Magnetic and Crystal Pickups," RADIO & TELEVISION NEWS, July 1950) the tone controls then being set as for a magnetic pickup. Superior pickup damping is claimed for this latter scheme. Tests on the present equipment show good but inconclusive results in this regard. A final point concerns the "Gain" control. Its low value of 100,000 ohms was selected as it must drive the *IRC* loudness control.

Both "B+" and d.c. heater power are obtained from the power amplifier. It is necessary to obtain 150 ma. at 37.8 volts (in practice a somewhat higher voltage is designed for to allow for output tube aging) for the three 12SJ7's in series. Fortunately, the Williamson output stage has about 125 ma. at 39 volts available at the cathodes. Thus it is only necessary to add 25 ma. from "B+" through a bleeder, as shown in Fig. 4. The extra drain on the power supply is usually of no consequence.

Other power amplifiers may require somewhat different modifications, depending on the current and voltage available at the cathodes. It should be noted that the balancing circuit used requires the output tubes to be plugged in the right way. A 250-ohm dummy resistor is provided on the power amplifier chassis to replace the 12SJ7 heater string when the preamplifier is not used. A jumper plug, replacing the preamplifier power connector, makes the connection. Thus, a power amplifier converted as shown is not harmed in any way and may still be used as before. —30—

TUBE TECHNIQUES

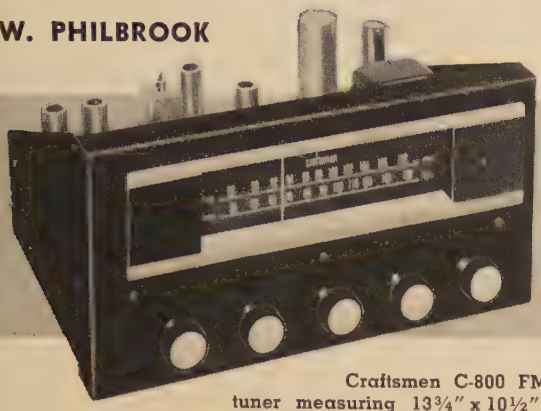
THE National Conference on Tube Techniques, sponsored by the Department of Defense, will convene at the Western Union Auditorium, 60 Hudson Street, New York 13, New York, October 13, 14, and 15.

The program of the meeting will cover all phases of electron tube making techniques, processing, and materials. Fifteen-minute papers on such subjects as cathodes, phosphors, vacuum techniques, glass-to-metal seals, insulators, etc., will also be given.

For further details on this conference, contact Harold J. Sullivan, Research and Development Board Committee on Electronics Panel on Electron tubes, 346 Broadway, New York. —30—

HE RADIO CRAFTSMEN MODEL C-800 TUNER

By **W. PHILBROOK**



Craftsmen C-800 FM-AM tuner measuring 13¾" x 10½" x 7".

Details on a high-quality tuner designed especially for custom fidelity systems.

T INTEREST to devotees of high-fidelity reproduction is the recently developed C-800 FM-AM tuner, made by *e Radio Craftsmen, Incorporated,* Chicago manufacturer custom high-fidelity equipment.

The tuner circuit itself offers wider bandwidth, providing eater AM fidelity and sharper i.f. bandpass "skirts" for eater selectivity than its predecessor model, the *Crafts-n* RC-10 tuner.

The instrument features separate tuned r.f. stages and ode converters on both FM and AM bands to insure low se level. A 10 kc. whistle filter is used to eliminate AM jacent-channel heterodyne whistle.

A double-shadow tuning eye and no-drift a.f.c. on FM nplifies tuning. A front-panel control cuts out the a.f.c. en tuning weak stations. A completely shielded chassis sign, including a bottom plate, minimizes oscillator radi-on and helps to insure isolation. The tuner is highly nsitive—requiring only 5 microvolts to obtain a usable nal on either AM or FM.

The audio output is from a cathode follower enabling mote installation and provides 2 volts at less than ½ r-cent distortion. The detector output also provides a thode follower for recording applications. The output tches high- or low-gain amplifiers with input im-dances of 10,000 ohms or higher.

In addition to providing AM and FM coverage, this tuner so incorporates a phonograph preamplifier and record qualizer on the same chassis. The inverse feedback, com-nsated dual-triode phono preamplifier provides correct rnover and roll-off characteristics to cover three of the st often used equalization characteristics, the AES, LP, d European recordings. A front-panel switch permits e selection of any of these characteristics. Input jacks e also provided for television and "spare" (an additional ut that can be used if desired).

The front panel controls are, from left to right; the lector switch, bass, volume, "on-off-treble," and tuning. e selector switch permits the choice of (in clockwise tation) FM, FM-a.f.c., AM, TV, LP, AES, European, and e "spare." The dual tone controls are continuously riable from 15 db boost through 15 db attenuation with le flat position clearly marked.

The tuner uses fifteen tubes, a 6CB6, two 12AT7's, two A6's, four 6AU6's, one 6AL5, two 12AX7's a 6AV6, a L7GT, and the 5Y3GT rectifier.

The entire unit is housed in a chassis measuring 13¾" x ½" x 7". It is also available with a mahogany-finished od cabinet which measures 16" x 11¾" x 9¼". —30—

Technical BOOKS

"TELEVISION AND RADIO REPAIRING" by John Markus. Published by *McGraw-Hill Book Company, Inc.*, New York. 544 pages. Price $7.95.

This volume is a primer for would-be service technicians and is written as simply and clearly as possible so that the student will have no trouble handling the material presented.

The text material is progressive so that from the first chapters the student can begin repairing receivers, progressing to more complicated sets of all types.

The first two chapters comprise a down-to-earth survey of the servicing field, its opportunities, advantages, and disadvantages. They also cover tools required, service manuals, establishing credit, how to order replacement parts, etc.

The balance of the book is a step-by-step "guided tour" through radio and television circuitry expressed in the simplest, non-technical terms.

Since no previous knowledge of servicing or electrical theory is required of the reader, this book should be a natural for the beginner who wants to enter this interesting and profitable profession.

* * *

"NEW SCREEN TECHNIQUES" Edited by Martin Quigley, Jr. Published by *Quigley Publishing Co., Inc.*, Rockefeller Center, New York 20. Price $4.50.

This is a compilation of articles written by leading authorities on all phases of three-dimensional screen and sound techniques.

Included are papers on such subjects as "Polaroid" and 3D films, basic principles of 3D photography and projection, "Natural Vision," the stereo window, 3D in Europe, Cinerama, Cinemascope, sound for Cinemascope, etc.

The text is lavishly illustrated and carries a preface by Dr. Alfred N. Goldsmith.

Those concerned with all phases of movie film and sound will find this symposium of value.

* * *

"AUDIO AMPLIFIERS AND ASSOCIATED EQUIPMENT" compiled and published by *Howard W. Sams & Co.*, Indianapolis. Vol. 4. Price $3.95. Paper bound.

This is the Fourth Volume in the *Sams* library covering amplifiers and has been prepared for the audio engineer, service technician, and others interested in amplifiers and amplifier circuitry.

A cumulative index covering all four volumes is also included. Each amplifier is pictured with special controls identified, complete parts list, and circuit diagram.

This volume, used in conjunction with the other three books, will pro-

a complete service library covering postwar ampli-

* * *

DIO AMATEURS' MOBILE HANDBOOK" by William rr, W6SAI. Published by *Cowan Publishing Corp.,* York. 186 pages. Price $2.00. Paper bound.

his is a practical handbook for the mobileer and covers motive electrical systems, mobile power supplies, mo- receivers, noise suppression, mobile transmitters and nnas, and test equipment for mobile equipment.

nce it is written by a ham for hams, the treatment is ise and fact-packed. The lavish use of circuit diagrams photographs helps to advance the subject matter rap- and provide the reader with practical working dia- ns of tested circuits for mobile use.

etails on commercially-built mobile equipment are also ided along with data supplied by the manufacturers nselves in a special "catalogue" section of the text. oth old timer mobileers and those about to join the ternity" will find this book of interest.

* * *

TO RADIO SERVICE DATA MANUAL" compiled and lished by *Howard W. Sams & Co.,* Indianapolis. Vols. d 3. Price $3.00 each volume. Paper bound.

ue to the immediate and enthusiastic acceptance of first volume of this series, the publishers have brought these two additional handbooks to cover most postwar receivers.

s was the case with the earlier volume, each set is pic- d, identified as to manufacturer, tube line-up, and nment data provided. A complete parts list with re- cement part numbers is given for each receiver in tion to the complete schematic and top and under- ssis views.

y adding these two volumes to his service library the nician specializing in auto radio work ought to be y equipped to handle any set that comes into the shop.

* * *

MANUFACTURERS' RECEIVER TROUBLE CURES" ed by Milton S. Snitzer. Published by *John F. Rider lisher, Inc.,* New York. Vol. 4. 115 pages. Price $1.80. er bound.

his is the fourth in the current series of pocket-size dbooks for the service technician. As was the case with previous releases, this book lists specific cures for ice faults as devised by the manufacturer of the set question.

his volume covers *Philharmonic, Pilot, Radio and Tele- on, RCA Victor, Remington, Scott, Sears Roebuck, Sen- l, Setchell Carlson,* and *Shaw* receivers.

ubsequent volumes will cover other television receivers nufactured by other firms.

* * *

OST-OFTEN-NEEDED 1953 UHF CONVERTERS AND ERS" compiled by M. N. Beitman. Published by *Su- me Publications,* Chicago. 96 pages. Price $1.50. Paper nd.

With new u.h.f. stations going on the air almost daily, need for information on converters and tuners to be d with v.h.f. receivers to provide u.h.f. reception is ner urgent.

his volume covers the tuners and/or converters made fourteen companies, including mechanical and electri- details on each unit.

n addition there is a section on u.h.f. transmission and eption, installing *Admiral* u.h.f. channel strips, an- nas, and transmission lines. —30—

PHILADELPHIA HI-FI CONFERENCE

ILADELPHIA'S Third Annual High Fidelity Conference and Audio Show will be held November 3rd and 4th at the jamin Franklin Hotel in Philadelphia. The entire fourth r has been reserved for manufacturers' use in presenting demonstrations for visitors. The Crystal Room will be en over to displays by distributors and manufacturers as l as panel discussions and lectures by audio experts. omplete details on this event are available from Isadore ber, 105 Heatherwood Rd., Haverton, Pa. —30—

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

TUBES FOR U.H.F.

Sylvania Electric Products Inc., 1740 Broadway, New York, New York has recently issued a 16-page booklet entitled *"Sylvania* Tubes for U.H.F."

The publication provides information on the company's 6AN4 and 6T4 tube types which have been designed for v.h.f. and u.h.f. applications.

A copy of this booklet is available on request to the company direct.

* * *

WIRE CATALOGUE

A unique identification chart for electronic wire and cable is incorporated in the new catalogue No. 53 released by *Alpha Wire Corporation,* 430 Broadway, New York 13, New York.

This new approach to wire identification and correlation is set up on a two-page chart. It is designed to allow even the inexperienced to positively and quickly correlate one of the company's wires from a vague general description.

A copy of this 28-page catalogue is available from Dept. A of the company.

* * *

CATALOGUE SHEET

A four-page catalogue sheet which lists the firm's complete line of electronic equipment is now available from *Perma-Power Company,* 4727 North Damen Ave., Chicago 25, Illinois.

Items listed in the catalogue include a new TV voltage regulator, the company's deluxe model TV tube "Britener," the "C-Brite" tube "Britener," a TV insulated high-voltage grid cap assembly, etc.

Please make your request for a copy on your company or store letterhead.

* * *

ELECTRONIC COMPONENTS SYMPOSIUM

The text of all papers presented during the 1953 Electronic Components Symposium is now available in book form from the 1953 Electronic Components Symposium, Suite 1011, 621 S. Hope Street, Los Angeles 17, California. The price is $4.50 per copy.

The Symposium was held earlier this year in Pasadena under the joint sponsorship of the Radio-Electronic-Television Manufacturers Association, A.I.E.E., IRE, and the West Coast Manufacturers' Assn.

Thirty papers by recognized author-

s in the industry were presented at the meeting and included in this new publication.

* * *

PUBLIC SERVICE BOOKLET

CA Service Company is now distributing copies of a consumer booklet to TV service associations and nagers of Better Business Bureaus throughout the ted States.

ntitled "How to Give Your Television Set the Service Deserves," the 12-page booklet was prepared by the n as a public service and a tribute to service techni- ns throughout the nation who have done such an out- nding job in maintaining and servicing receivers.

he text is in a light vein with cartoon illustrations. It nts out that TV service technicians spend up to four rs in studying electronics to learn their work, and that y must take constant refresher courses to keep up on nges in receiver construction and new service data. addition, the booklet shows that the technician must est up to $10,000 in equipment and facilities before can start business.

ther plans for the booklet include distribution to *RCA* vision dealers, spot announcements describing it on A-sponsored radio and TV shows, and in the company's spaper and magazine advertising.

* * *

ELECTRONIC COMPONENTS

Waldom Electronics, Inc., 911 No. Larrabee St., Chicago issued a comprehensive catalogue listing ready-to- electronic components and *"Croname"* products.

esignated as Catalogue 5C3, the new publication lists re than two thousand items in stock. Included are er assemblies; mask, glass, and escutcheon kits; title tes, dial and switch plates; knobs; instrument drives l dials; terminal lugs, cases and dial locks; terminal ps, etc.

Write the company direct for a copy of this catalogue.

* * *

"WHEN U.H.F. COMES TO TOWN"

Philco Corporation has produced a new 15-minute edu- ional film for release to distributors in areas through- the country where new u.h.f. broadcasting stations are ng on the air.

Entitled "When U.H.F. Comes to Town," the film de- ts the actual activity and excitement created in a com- nity when a u.h.f. station starts broadcasting. It is de up principally of scenes filmed on the spot in new .f. television areas.

he film is available in 16 mm sound for showing to TV lers and others interested in building up enthusiasm the new u.h.f. television service. The Sales Training partment of the company, Philadelphia, will provide ditional information on how prints of the film may be ained for showings.

* * *

TRANSISTOR BULLETINS

Electronic Research Associates, Inc., Box 29, Caldwell, w Jersey is currently offering a new bulletin on avail- e types of transistors, manufacturers, and other sup- mentary data.

Also available is a several-page bulletin on the Model -11 transistor tester. Data is also provided on the del CC-60 constant current converter and the Model transistor power supply.

These bulletins are available from Dept. RN of the com- ny or by phoning Little Falls 4-1836, Caldwell, N. J.

* * *

TURNER CONVERTER

Turner Company, 900 17th Street, N.E., Cedar Rapids, va has announced the availability of a complete tech- al bulletin on its new u.h.f. converter, the Model TV-3. Copies of this bulletin may be obtained from electronic rts jobbers or by writing the manufacturer direct.

* * *

TRANSISTOR BULLETIN

Two new production types of hermetically-sealed, own-junction transistors are covered in Bulletin DL-S , recently released by *Texas Instruments Incorporated,* Lemmon Ave., Dallas 9, Texas.

The publication contains two pages on the theory and

application of junction transistors as well as detailed specifications and curves on the company's Types 200 and 201 *n-p-n* triodes with glass-to-metal hermetic sealing.

A copy is available without charge from the company.

* * *

SUBSTITUTION CHART

A time-saving substitution chart for television picture tubes has been compiled by *CBS-Hytron* engineers and is now available without charge from distributors, or direct from the company's main office in Danvers, Massachusetts.

The 8-page chart includes all electromagnetically deflected tubes, irrespective of make. An index leads to the proper substitution group listing all readily interchangeable types, and from this group the service technician can pick an available type with the least number of required service adjustments.

* * *

SHURE CATALOGUE

Shure Brothers, Inc. has just issued a new general catalogue, No. 44.

The publication covers microphones, microphone parts and accessories, phono cartridges and pickups, wire and tape recording heads and lists replacement information on phono cartridges, communications microphones, and magnetic recording heads of various manufacturers.

The catalogue is designed to be of maximum value to distributor countermen and salesmen, service technicians, sound dealers, hams, hobbyists, and engineers.

Write the company at 225 W. Huron St., Chicago 10, Ill. for a copy.

* * *

STANCOR TRANSFORMERS

Chicago Standard Transformer Corp., Standard Division, Elston and Addison, Chicago 18, Ill. has issued a 24-page catalogue listing complete electrical and physical specifications on almost 500 *Stancor* transformers.

Included in the listing are transformers for radio, television, high fidelity, amateur, military, and other electronic applications.

A cross index chart between obsolete power transformers and the current "8400" series power transformers has been included in the catalogue.

It is available without charge from *Stancor* distributors or from the company direct.

* * *

TAPE ERASURE

Minnesota Mining and Manufacturing Co., 900 Fauquier St., St. Paul 6, Minn. is offering a copy of its "Sound Talk" bulletin No. 24 to interested persons.

This particular issue deals with the a.c. erasure of magnetic tape and describes the theory and practice of a.c. erasure. It covers such points as orientation, speed, and the number of passes required. In addition, procedure for obtaining best results both with 60-cycle bulk erasers and with machines is outlined.

—30—

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

EVERYTIME we wade into a batch of statistics to try to interpret how contemplated or possible industry developments are likely to affect the business of independent service dealers, memory always brings to mind a discussion of mortality rates in combat that we sat in on during our stint in service during the recent world war.

It was a bull session in the barracks. The outfit was made up largely of airborne radio operators, potential tail and belly gunners, and various and sundry specialists in combat aircraft maintenance. The talk turned to ships lost in combat when one of the outfit's military masterminds came out knowingly with a lot of statistics about the comparatively low mortality rate among air force personnel.

Finally one of the boys who was ticketed for early assignment as a replacement in a combat outfit, said: "Those statistics are a lot of bunk to me. If I get in the road of a slug and can't come back under my own power as far as I am concerned the mortality rate is 100%."

Future and Independent Service

Although television has steadily advanced since the freeze was lifted last year, the mortality rate among small service businesses has increased since the presidential election year "boom" in service started to taper off after the turn of the year. Percentage-wise, the business mortality rate has been 100% for each of those expiring technicians who launched out on his own as an independent operator and "fell by the wayside" as business steadily tightened up.

But all forecasts for Fall business are very optimistic. With more than twenty-two million sets in operation, there will probably be a big rush for service when the baseball season and World Series stimulate a new interest in TV and in picture quality restoration.

A recent forecast of sales of TV sets during the coming four years indicates a possibility that thirty million sets will be sold during that period, providing a "mild recession" doesn't occur with the easing of international tensions. Against this volume of sales, this forecast estimates that about 4,000,000 older sets will be junked and destroyed. On the basis of these estimates, about forty million TV sets will be in use by the beginning of 1958.

It is, of course, impossible to measure at this time the effect color television developments will have on the sale of monochrome receivers. The National Television Systems Committee (NTSC) filed a petition with the FCC late in July for the establishment of standards based upon a system of compatible color television. *RCA,* who had filed their petition late in June, amended it slightly to conform exactly with the NTSC proposal. That the entire industry was backing the NTSC standards was clearly shown when Dr. Peter Goldmark, chief engineer of the *CBS* laboratories which developed the FCC approved *CBS* system for color TV, seconded the motion to accept the NTSC committees' recommendations for presentation to the FCC.

With the electronics industry solidly behind it there seems no doubt that the NTSC color TV system recommendations will get early consideration from the Federal

Communications Commission and all necessary steps leading to its acceptance will be completed at an early date. Then the big question will be—When the average prospective TV buyer sees a color receiver in operation will he put off buying a monochrome receiver and wait until he can get a color set?

However, no matter what happens, the market for service will continue to grow. TV sets that are kept in service for long periods of time will require more and more major service jobs to keep them operating. And as color television sets become available they will require a new level of technical competence and provide more volume for the capably managed shops.

Major Service Jobs

A TV service job that costs twenty-five dollars or more usually puts quite a strain on the budget of the average family. The American system of time payment purchases has developed a national habit of regularly splitting up the pay check to pay for many things on easy payments.

Automobile manufacturers realistically solved the problem of helping car owners finance major repair jobs by making car repair finance plans available through their regular financing agencies. This, of course, helped the car dealers retain their service customers but it was no help to the independent garages.

Here's how credit facilities were made available to independent garages according to Mr. Charles M. Cawley, vice-president of the Beneficial Management Corporation, in a speech before the National Sales Executives Convention:

"Not too long ago, the independent car repair business was losing ground to the large auto dealer franchises. A survey by a national magazine showed that the independent garage dealer's share of the auto repair business had dropped from 65% of the prewar market to a low after the war of 35%.

"One of our clients — a manufacturer of automotive parts — was disturbed about this trend, as well he ought be. He sells his product largely to independent garages, and they, in turn, install them in cars brought in for servicing and repairs. The less business they did, the fewer units he sold. And based on the trend, he was going to sell less in the future.

"An analysis of this situation convinced this manufacturer that the only way his independent garage dealers could compete with large automobile dealers was to have all of their advantages. This meant, among other things, a sound credit plan—which most of the independent garage dealers did not have.

"Therefore, between us we created a Car Credit Plan for garages. This is sold as a part of the merchandising package which the manufacturer makes available to his dealers. The manufacturer's salesmen back up the

kage by merchandising the credit plan to the local ers—explaining its advantages, giving full details of operation, and holding meetings to tell them how rs have used it successfully."

any service dealers have plans of their own which le the set owner to buy a new picture tube on a thly payment plan. However, a service business ld have to have substantial cash resources to handle kind of financing themselves. Usually, arrangements made with the dealer's bank to handle this "paper." ks and financing agencies have both the facilities and proper psychological atmosphere for handling col- ons.

he important thing about any time payment plan is it must be simple and the credit information assem- and passed on without embarrassment to the cus- er. Most people are annoyed when they are asked to ish information about themselves for a credit report. e dealers handle this smoothly by calling their credit ements "Let's Get Acquainted" Reports and the per- el who handle them are thoroughly indoctrinated ow to get the needed information by "getting ac- nted" with the customer.

t of Doing Business

the continuing surveys conducted by your editors to her specific information on all phases of electronic ice business operation one of the most important but ive factors is the cost of making home service calls. s appalling to find that only a very small percentage ervice dealers know what it is actually costing them o business.

he more successful businesses, of course, know their s. The following breakdown recently furnished us by ajor service business in a metropolitan city, details r cost of handling home service calls. These figures based upon 1000 calls and the time factor involved udes time spent checking in and out, in handling ex- ges of parts, etc. The time averages out at 1⅛ hours call. Here is the detail and the total cost-per-call this company:

⅛ hrs @ $2.00 (minimum scale)	$2.25
miles travel @ 7c per mile	.56
ispatch & management of routes	.40
lerical, bookkeeping, rent, heat, light, and iscellaneous expenses	.76
dvertising	.50
epreciation & investment	.18
Total cost per call	$4.65

all of the analyses that have been furnished us, the of making home service calls based upon actual costs peration run from $4.55 to $5.37 per call, the variations g due largely to the individual characteristics of the a where the TV service business operates. These fig- s are from efficient business enterprises where manage- t is continually studying costs of operation to increase iency and provide the highest grade of competent nical service.

it actually *costs* more than $4.50 to handle home serv- calls how, you may logically ask, can those technicians rate who advertise home service calls for $2.50 or 0?

an effort to find some answers to this question your ors recently contacted nine TV technicians in a lium-sized city who were advertising home service s for $2.50. It is interesting to note that although every of these men claimed he was making a *good* living dling service at $2.50 per call, five of them had plans discontinue their independent work as soon as they d jobs that would pay eighty dollars per week or e.

he illusion that leads technicians to feel they can e more money "on their own" by handling service s at $2.50 each is explained in this composite analysis hinking composed of the information developed in all hese interviews:

While working for a regular TV service dealer the nician averages 8 calls per day for which his boss

collects $5.00 per call plus the pro on the tubes and parts used in serv ing the sets. The technician reas that where he is making eight call day working for someone else, could work a little harder working himself and average 10 calls per d

At ten calls per day, he reasons, will make $25.00 a day for his la plus the profit on the tubes and pa he sells. He concludes that by wo ing six days a week he will get $15 for his labor and the profit on tu and parts will pay his operating penses.

The delusion occurs after he tried for ten months to make his come take care of his outgo work at $2.50 per call.

The fundamental fault of this k of reasoning is the assumption t day-in-and-day-out, Spring, Summ Fall, and Winter—throughout the weeks of the year—ten TV set own will call him for service. It doesn't work out that way.

If a technician is able to aver ten sets serviced in the home day to the satisfaction of the owners, that is his *maximum* poten of business, operating alone. F the limited funds available to from his maximum potential the vertising he can buy would not duce an average of one-third, 3 c consistently throughout the year. S every once in a while when every seems to need TV service at the s time and all shops are swamped, will be exposed to more business t he can handle. But those are rare stances. Averaged out over a yea business of six sets per day is diffi to maintain for the independent t nician with limited promotional sources.

The final results are usually same: At the end of a year the t nician who started out on his with inadequate resources has a w out car, debts, and a yen for a with a guaranteed salary.

We would like to point out, tho that there are some exceptionally men who operate successfully as man TV service businesses. But r of these men handle service fo group of reliable set dealers and subsequent COD service for t dealers' customers after the sets out of warranty. By maintainin mailing list of all of the set purcha they have handled for dealers are able to confine their sales motion to users they have worked and who are acquainted with th And it is interesting to note tha of these people your editors have tacted get $5.00 per call for h service.

TV Service Is Complex Business

The operation of a successful service business is a complex un taking. In the first place, it requ substantial financing. The studi successful service businesses mad your editors in all sections of country show that a ten thou

capital investment is nominal. Managers of service
esses employing only four technicians are usually
of their ability to hold their replacement tube,
and equipment investment *down* to *only* $3000.
icians working on their own with limited stocks lose
ge part of their effective working time in trips to
houses to pick up needed parts or tubes.
biggest problem that faces any service business is
f maintaining an adequate volume of business. As
ne quipped the other day, "It certainly pays to
tise. There are 26 mountains in Colorado higher
Pike's Peak." But advertising can be both expensive
neffective. A service business needs a service selling
am that is designed for its individual needs and sec-
Merely advertising doesn't pay off.
vice organizations capable of supporting four or
technicians have proven to be the most consistently
ssful television service businesses. This size organi-
n, with an adequate business control system, permits
man to give his time to the phase of the work for
he is best qualified and allows the operating execu-
ime to devote to the task of maintaining the volume
rvice work that the organization requires to pay its

Owner Education

e most important part of the job of public relations
half of independent service that needs to be done is
quaint the public with what they should expect to
for competent service. They have been given no
tick with which to measure whether a service
ge is low or high. In buying service on their cars,
have been educated by auto dealers to pay a flat rate
arious types of service plus the cost of the parts and
ies needed.
e American public has acquired an interesting "price
aisal habit." If they have been educated to pay a
in price for a particular kind of service and have
l that service to be satisfactory at that price, they
e skeptical or suspicious of anyone who offers to per-
that same service for less money. Most everyone
been stung sometimes by an "I'll-do-it-for-less" char-
.
e education of the public about what to expect to pay
ompetent TV service must be done by the independ-
service operators themselves. Legal restrictions pre-
the industry as a whole from promoting this type of
mpaign.
metime ago the Bureau made a national survey of
standard charges for TV service operations that or-
zations in different sections of the country are using.
ages of these charges were used in developing a
dule of average charges. This schedule was made up
chart titled the "Standard Labor Charges for Televi-
Service and Repairs."
undreds of service dealers bought these wall charts
asked about a mailing piece listing these charges that
d be mailed or given to TV service customers. This
t has been reproduced as an 8½ x 11 flyer which,
ed three ways, can be mailed in a standard # 10
lope.
e chart is also available in the form of a printing
. Some service businesses wanted to make up their
mailing pieces. They can do this by writing their own
to go on one side of an 8½ x 11 flyer, and their
ter can cast type from the mat to print the standard
r charges schedule on the other side of the flyer.
hese mats are available from the Bureau at $2.00
. For information about it address your letter to:
LB Information Services, P.O. Box 1321, Indianapolis
ndiana. Please enclose a stamp or a stamped envelope
reply.

TV Consumer Booklet

he *RCA Service Company* recently announced a new
sumer booklet that lauds the independent TV service
nician and tells an interesting story about what the
technician does, to provide competent TV service.
gives a graphic presentation on Pages 10 and 11 of

"What goes into the bill for the services of a qualified television technician."

In sending copies of this consumer booklet to all dealer and service organizations, Mr. E. C. Cahill, president of the *RCA Service Company* said: "All far-sighted people in this industry are dedicated to the objective of keeping up the present high standards of the television service, so that we may be recognized not only for the part we play in bringing good service and enjoyment to the customers we serve but also as worthwhile members of the communities in which we live."

The *RCA Service Company* cr line is not only very modest but i itself a very fine tribute to mem of the independent TV service ternity.

These booklets are available service businesses at the *RCA S ice Company's* cost of 3c per book They are known as Form 2244 may be obtained through *R. L. D & Co. Inc.*, 809 Chestnut Street, Ph delphia 7, Pa.

—30—

MEET "OLD TIMER" ANTHONY HAGEN

By C. HOWARD BOWERS

WE ARE interested in finding out what has become of all the old time wireless operators — those who started about 1912. We are attempting to develop this information through this column, and we hope it will prove interesting to radiomen of lesser years' experience. If you qualify as an "Old Timer," write us care of this column.

In this issue we scan the career of ANTHONY HAGEN, 1416 Stickney Avenue, South St. Paul, Minn. Mr. Hagen's first experience as a commercial wireless operator was in 1911 at Isle Royale, Michigan, for the old Marconi Wireless Company of The Great Lakes, and later as a night operator at Duluth, Minn. Taking to water, "Tony" subsequently shipped out as operator aboard the "SS American," then in succession the steamers "Lakeland," "Tionesta," and various ore vessels. Mr. Hagen says his equipment consisted of both 2 kw. and 5 kw. transmitters, with plain and rotary spark gaps, together with old type Leyden jar condensers. Receivers were the slider-type tuning coils with carborundum and silicon crystal detectors. This equipment was remarkable for its inefficiency and, quoting Mr. Hagen, "The receivers so insensitive that QRM from flock sea gulls was eliminated by wrappi towel around one's head, over the phones, thereby causing remarks the passengers as to what we had dr the night before!"

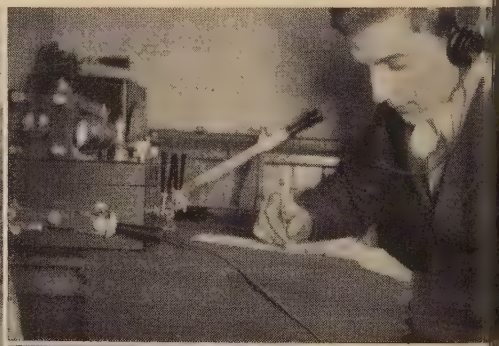
Shore duty about 1912-1913 paid subject Wireless Man the munificen ary of $75.00 per month, seven per week, while shipboard duty $48.00 per month, board and roo cluded.

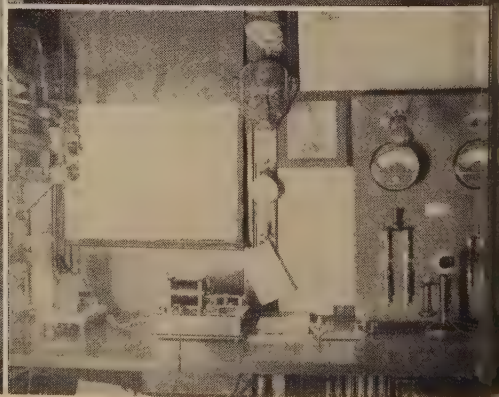
In 1917, Mr. Hagen enlisted for ice in World War I and acted as coo structor. After that tour, he en business for himself but later acc employment with the Pullman Com as an electrician, where he is today

"Tony" Hagen is now middle "But I can still remember," he "when the 'Wireless Age' magazin fered $5.00 for original crystal set ups in 1913 and, yet today in RAD TELEVISION NEWS comes an off $10,000.00 in prizes for crystal ups, only they call them transistors

We doubt if Mr. Hagen still f old style wireless.

"Tony" Hagen as he looks today (left) and as he looked at the beginning of his ca reer forty years ago. (Below) The old Marconi Wireless station at Duluth, Minn





GEE OFFERS YOU TERRIFIC VALUES IN T. V. BOOSTERS—AMP'S AND KITS

NDARD COIL SUPER CASCODE TUNER $19.95

Replace that old tuner with a new cascode—another McGee scoop

code Circuit of the Standard Tuner offers a new development famous TV front end assembly which affords a 2-to-1 im-ent in gain and a 35% to 50% reduction of noise over the tuner. Other advances include: easy conversion to UHF re- by interchange of channel inductors; increased sensitivity for in fringe areas; elimination of booster use; and a high profit r the serviceman as a replacement unit sale. Brand new factory compl. with tubes 6BK7 or 6BQ7 and a 6J6. Shaft length 3¼" or 4½". TV-2000 TV

14-Inch Conversion Kit WITH G.E. TUBE $25.95

14-inch conversion kit: You get a 14-inch black face, 1 year guarantee G.E. 14CP4 picture tube, a 70° deflection yoke with matching 14,000 volt G.E. flyback and a 14" plexiglas gold trim safety mask, plus conversion instructions. Stock No. 14CC-G, Sale price, $25.95.

H CONVERSION KIT $25.95

conversion kit with a 17BP4A, tangular blackface electro-magnetic cture tube with 6 months' guaran- a matched 70° cosine yoke, a G.E. 1,000 volt flyback and a 17" rec- gold trimmed plexiglas mask and shield. Suggested diagram furnished. weight, 30 lbs. via Express or nly. Stock No. 17-4XL, 17" con- kit. Sale price, **$25.95.** Kit Price or Raytheon 1 year guarantee pic- e, **$5.00** extra.

20-Inch Conversion Kit $29.95

Our 20" conversion kit includes a 6-month guaranteed 20HP4, 20" rectangular blackface picture tube, plus a 14,000 volt G.E. built high voltage flyback transformer, plus a matched 70° cosine yoke, plus a 20" rectangular gold trimmed plexiglas mask and suggested diagram. The picture tube is the latest electro-static focus type that requires no focus coil. Shipped via express or truck only. Ship. weight, 40 lbs. Stock No. 20-TP, net price, **$29.95.** Price with Raytheon or GE 1 year guarantee picture tube, **$10.00** extra.

SPEAKER AND BAFFLE SALE

8" SPEAKER AND BAFFLE $4.95

Stock No. 818. Tan leatherette covered, plywood slant type wall baffle: plus an 8" Oxford, 2.15 oz. Alnico 5 magnet PM speaker. A red hot McGee special for only **$4.95** each, or **$4.70** each in lots of 3 or more.

PEAKER AND BAFFLE $6.50

o. CA-10. Tan leatherette covered l slant type wall baffle; plus 10" V PM speaker. Only a few hun- to sell at **$6.50** each, or **$6.25** lots of 3 or more.

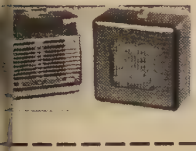
12" SPEAKER AND BAFFLE $7.95

Stock No. CA-12, Tan leatherette covered plywood slant type wall baffle; plus a 12" Alnico V magnet PM speaker. A terrific McGee value for only **$7.95** each, or **$7.50** each in lots of 3 or more.

STATION INTERCOM MASTER $16.95
SUB STATION $3.95

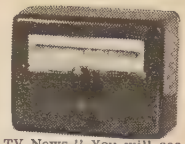
3-station intercom master housed in chrome plated metal cabinet 7½"x6"x5" sloping front. Full 3-tube amplifier for 110 volt AC-DC operation. Press-to-talk switch is on top of the cabinet and volume control with off-on switch and station selector switch are on either side. May be used with from one to 3 sub-stations. (See matching cabinet chrome plated sub-station No. PM-A5). Master is quiet at all times except when press-to-talk switch is pressed at the master or call-back switch is pressed at the sub. Uses 3-wire intercom cable. 3-station intercom master MPM-A3, shipping weight 10 lbs. Sale price, **$16.95** each, sub-stations extra. 3-wire plastic intercom cable, 100 ft. for **$1.95**, 500 ft. for **$8.95.**

D INTERCOM SUB-STATIONS TO SELL AT $3.95 EACH



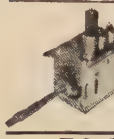
Chrome plated, with call back switch for a 3-wire intercom master. Size 7½"x6"x5" sloping front, 5" Alnico V PM spkr. Intercom dealers buy at less than present production costs. Limited quantity. Stock No. PM-A5, ship. weight 8 lbs. Sale price, **$3.95** each or 3 for **$10.00.** Special 3-wire plastic intercom cable. 100 ft. **$1.95**, 500 ft. for **$8.95.** Brown leatherette covered intercom sub-station with call back switch for use with 3-wire intercom masters. 5" square and 2½" deep. Has new plastic grill cloth, Alnico V PM speaker. A true McGee value. Stock No. NE-5, ship. weight, 1¼ lbs. Sale price **$3.95** each or 3 for **$10.00.** 3-wire plastic intercom cable. 100 ft. for **$1.95**, 500 ft. for **$8.95.**

FRINGE AREA TV RECEPTION IS BETTER WITH OUR McMURDO SILVER TV BOOSTER $10.95—TWO FOR $20.00



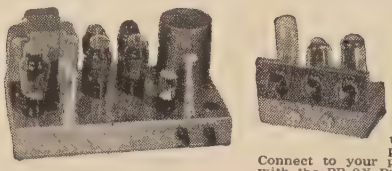
Read the article on pages 52 and 53 of the December "Radio & TV News." You will see how a booster like McMurdo Silver Super Sonic was used for fringe area TV reception. We can't guarantee this unusual reception, but we will guarantee this booster to be a sensational value. Continuously variable inductance type tuner from channel 2 including the FM band through channel 13. Self-powered for 110 volts AC operation. Incorporates a 6J6 tube. Input for 300 ohm TV line and 300 ohm output to TV set. Single knob tuning. Attractive plastic case. McMurdo Silver Super Sonic TV-FM booster Stock No. GB-6B, shipping weight 5 lbs. Sale price, **$10.95** each or two for **$20.00.**

3-TUBE SARKES-TARZIAN T.V. TUNER $9.95



This popular Sarkes-Tarzian Type 3 tuner is widely used. 13 channel rotary type switch with individually tuned coils. Price is complete with diagram and three tubes: 6C4 osc., 6BH6 R.F. and 6AG5 mixer. Regular factory cost is twice our price. Each tuner is wired ready to hook up to a video and sound IF strip. May be used with either inter-carrier or separate sound IF circuits. Has built-on convertor coil, built in fine frequency control. Sarkes-Tarzian TV tuner, with 3 tubes. Net price, **$9.95** each. Shaft length, 2⅞".

50-WATT BOOSTER AMPLIFIER



50-WATT BOOSTER AMP. $39.95

2-Mike Pre-Amp $12.95 Extra. Not a Kit, but a Manufactured Amp.

50-WATT BOOSTER A sensational value, 50 watt booster amplifier with push-pull parallel 6L6 output tubes. Connect to your present amplifier as a booster or use with the PR-2X Pre-amp to add the use of 2 mikes and one low level input. The booster amplifier has one input jack and with 1 volt input gives 50 watts of audio. Booster has a 6 lb. potted case high fidelity output transformer, matches speaker with 4-8-16 ohm voice coil, also 60 ohm and 250 ohm line. Booster has a 225 mill power supply with 5U4 rectifier. Price includes tubes: 4 6L6, 7N7 and 5U4. The two variable controls are for master volume control and bass boost tone control. Size 8 x 6½ x 14½. Stock No. PA-55N. Shipping weight 26 lbs. Sale price **$39.95** ea.

2-MIKE PRE-AMP. Pre-amplifier plugs in directly to the PA-55N Booster amplifier. It enables use of 2, Crystal or Dynamic Mikes plus one low level input. Furnished with 4 foot cables and plugs for remote control use of 55 watt Booster Amplifier. Small chassis size 5 x 3¼ x 4". Stock No. PR-2X, with tubes 7F7 and 7N7. Net price **$12.95** ea.

McGEE'S $62.50 LIST 15" COAXIAL SPEAKER, $23.95

New 1953 Model—21 Oz. Alnico V Magnet—5" Tweeter

This is the finest 15" coaxial PM speaker value that we have ever offered. New 1953 production of a famous manufacturer of fine speakers. The 15" speaker has a 21¼ oz. Alnico V magnet; equal to 68 oz. of the Alnico 3 type magnet. The cone is free floating, of one piece construction. Will reproduce low frequencies down to 20 cps. The 5" tweeter is coaxially suspended and has a ridged cone to reproduce only the high frequencies. It will respond up to 17,500 cps. The high-pass filter is concealed under the pot cover, leaving only two wires to connect both the tweeter and woofer to any 8 ohm output transformer of a radio, or high fidelity music lover's amplifier. Stock No. P-15CS, shipping weight 13 lbs. Net price **$23.95.**

12" COAXIAL SPEAKER, $12.95

McGee offers the new 1953 model 12" coaxial PM speaker. Quality you would put in your finest sets if you were a manufacturer. 12" woofer has 6.8 oz. Alnico V magnet. Tweeter is coaxially suspended and has a metal diffuser. High pass filter is under the pot cover. Only two wires to connect to your radio or audio amplifier. 8 ohm with 18 watt peak and 10 watt average. Shipping weight 8 lbs. Response from 30 to 17,500 cps. Stock No. CU-14Y, Sale price **$12.95** each; 2 for **$25.00.**

12" JENSEN PM, $15.95

Another McGee Scoop! Jensen Concert 12", 14½ oz. Alnico V magnet PM speaker. 8 ohm voice coil. Will take 25 watt audio. You save dollars on this speaker. Just 100 to sell. Shipping weight 8 lbs. Stock No. P-12P. Sale price **$15.95**; 2 for **$30.00.**

G.I. 3-SPEED CHANGER WITH G.E. $22.95

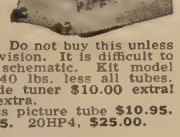
VARIABLE RELUCTANCE TURN-ABOUT CARTRIDGE

Another tremendous McGee Scoop! Brand new General Instrument 3-speed automatic record changers. Complete with RPX-050 G.E. variable reluctance cartridge with turn-about stylus. Plays all 3 speeds automatically: 7", 10" or 12" records. Has reject button. Repeats last record. Base size, 12"x12⅞". Shipping weight 14 lbs. Stock No. 700-GE. Scoop price. **$22.95.**

GI 3-speed changer same as above, but with Webster flip-over twin needle cartridge. Stock No. GI-700. Sale price, **$21.95** each.

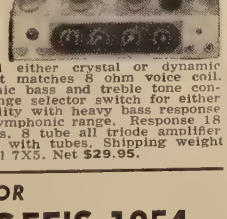
COMPLETE RADIO, TELEVISION AND AMPLIFIER KITS AT McGEE

0" T.V. Kit $59.95 Less Tubes



plete kit of to build an nsformer op- television for use with 17" or 20" ular picture The 12 chan- arkes-Tarzian r is ready as is the 4 deo IF strip. is of the tional design. Do not buy this unless derstand Television. It is difficult to We furnish schematic. Kit model Ship. wt. 40 lbs. less all tubes. 59.95. Cascode tuner $10.00 extra! eaker $2.95 extra. 19 tubes, less picture tube **$10.95.** 7BP4A, **$17.95.** 20HP4, **$25.00.**

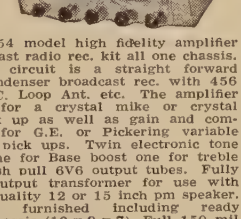
8-Tube Hi-Fi Amplifier Kit $29.95



A complete kit, including tubes: 3-7E5, 2-12AX7, 2-triode plus rectifier diagram and photos. Inputs for radio tuner and any kind of phono pickup (crystal or G.E. variable reluctance) and either crystal or dynamic mike. Output matches 8 ohm voice coil. Twin electronic bass and treble tone controls with range selector switch for either juke box quality with heavy bass response or brilliant symphonic range. Response 18 to 20,000 cps, 8 tube all triode amplifier kit, complete with tubes. Shipping weight 25 lbs. Model 7X5. Net **$29.95.**

1954 Model 9-Tube Radio-Amp-Kit

BUILD IT FOR **$29.95**



A new 1954 model high fidelity amplifier and broadcast radio rec. kit all one chassis. The radio circuit is a straight forward 3 gang condenser broadcast rec. with 456 i.f.'s A.V.C. Loop Ant. etc. The amplifier has gain for a crystal mike or crystal phono pick up as well as gain and compensation for G.E. or Pickering variable reluctance pick ups. Twin electronic tone controls one for Base boost one for treble boost. Push pull 6V6 output tubes. Fully shielded output transformer for use with any high quality 12 or 15 inch pm speaker. Everything furnished including ready punched chassis (12 x 9 x 7). Full 150 mil power trans. all parts tubes and diagram. Tube complement 6AK5 RF. 6BE6 converter, 6AU6 I.F. 6AT6 det. 1st audio. 12AX7 mike V.R. stage. SL7 phase inverter. Two 6V6 audio. 5Y3 rect. Stock No. BKR99. Ship. weight 20 lbs. Sale price **$29.95** (less speaker). 12 inch Coaxial PM Speaker **$12.95** extra. 15 inch Coaxial PM Speaker **$23.95** extra.

3-Speed G.I. Changer with variable reluctance cartridge **$22.95.**

3-Speed Garrard Changer with RPX050 G.E. cartridge **$47.40** extra.

Crystal Mike and Desk Stand **$4.95** extra.

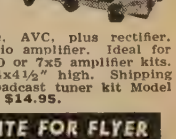
6-TUBE 2-BAND KIT $14.95

Popular with schools and colleges for training. 6 tube AC-DC 2 band radio kit with plastic cabinet. Receives broadcast and 6 to 18 mc shortwave. Full 2 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12SK7, 12K8, 12SK7, 12SQ7, 50L6 and 35Z5, diagram and instructions. Factory quality. Cabinet size 13"x6¾"x6¼". Shipping weight 12 lbs. Model ME6-2. Net **$14.95.**

5-TUBE AC-DC KIT $12.95

Model RS-5. A 5 tube AC-DC straight broadcast kit, housed in the same cabinet as ME6-2 above. Complete with tubes. Shipping weight 10 lbs.. Net **$12.95.**

AC POWERED BROADCAST TUNER KIT $14.95



A self-powered, 3-gang superhet tuner kit with R.F. stage. This complete kit is furnished with a diagram, photos and tubes. 6BA6 R.F., 6BE6 oscillator R.F., 6BA6 I.F. detector, 6AL5 diode. AVC, plus rectifier. Connect to any audio amplifier. Ideal for use with our S-2020 or 7x5 amplifier kits. Chassis size, 9½x4x4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, **$14.95.**

n Your Own Wno-Mike adcaster $7.95

odel DE-6R. With mple kit, you can a 3-tube phono tor that also has ke input. Will ast over any ra- thin your home, (about 75 feet) from o 1500 kc. Inputs for crystal mike or phono pickup. Fader control fades ike to record. Ideal for a home P.A. baby listener and home entertain- A complete kit of parts including Kit Model DE-6R. Net price, **$7.95.** WT, wired and tested. Net price, Crystal mike and desk stand, **$4.95** Concealed microphone unit, only 1" meter and ¼" thick. Specify hidden when ordering. Stock No. T-001. Net extra.

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Novice Receiver

(*Continued from page 47*)

makes it almost as easy as a two-terminal coil. For example, taking the 80-meter coil with its 21½-turn, center-tapped coil, start with two pieces of wire about three feet long. Twist two inches or so of these wires together and put them through the proper hole in the coil form and solder them into the pin at the bottom of the form. Now wind one piece of wire towards the top end of the coil form, run it through its proper hole and solder it to its pin, then wind the other piece of wire in the opposite direction down on the coil form to its hole and solder it to its pin connection. The fractional turn counts given in the coil data are caused by the fact that the holes for the wires are drilled above the appropriate pins on the coil forms. These pin numbers are shown at the ends of the coils in the schematic diagram. The spacing between the primary and the tickler coils is about one-quarter inch in the case of both the 80- and 40-meter coils and the tickler is wound on the lower end of the coil form. Be sure to wind the primary and the tickler (the small coil) in the same direction.

Naturally the enamel insulation will have to be removed from the ends of the wires before they are soldered. It will help considerably in soldering the coil wires into their pins to "tin" them lightly before inserting them, by giving them a thin coat of solder. The builder will notice that the wire ends and terminals of the various parts, such as resistors, condensers, etc. have already been tinned by the manufacturer. The coil need not be scraped or tinned much more than half an inch.

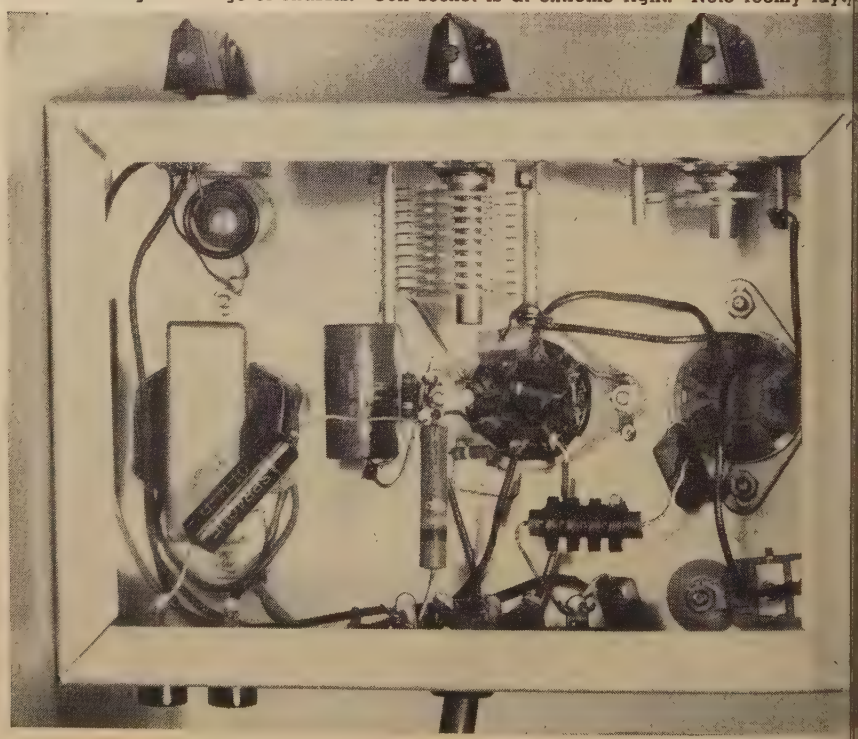
The two tuning condensers and regeneration control are mounte the front edge of the chassis and phone tip jacks and power cord brought out through the rear A plate load resistor and bloc condenser are used in the ou stage to keep d.c. off the headp wires.

When the wiring is completed checked for correctness, you are r to try the receiver. After a mo or so of warmup, turning the reg ation control clockwise should ca "plopping" sound in the headph This plopping sound occurs at point where the detector breaks oscillation. On the clockwise si this point, there should be a s rushing sound in the headset whi the counter-clockwise side the only silence. Voice reception achieved with the regeneration trol set just short of the regener point while code is received wit control turned over into the reg ative state.

Almost any length of wire ma satisfactory receiving antenna, p ably one over 30 feet long. The wire you use for transmitting m an excellent antenna for the rec if you provide a single-pole, do throw switch to change the ant from transmitter to receiver d standby periods.

With a simple receiver of this and a long receiving antenna, th a possibility of cross-modulati you live near a strong broadcas tion or other powerful transm Cross-modulation causes the b cast program to be heard in the

Under-chassis view of the Novice station receiver. The audio transformer is se at left, below the regeneration control. Phone tip jacks and power cable can seen along rear edge of chassis. Coil socket is at extreme right. Note roomy lay



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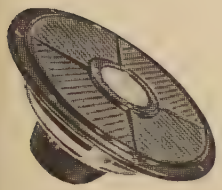
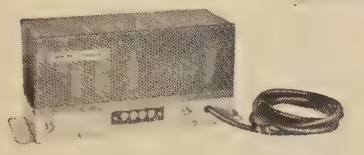
Custom Music Ensemble



G-E DUAL COAXIAL SPEAKER
Model A1-400

...w approach to coaxial speaker de...n—high sensitivity at low cost. ...ieptional balance between speakers ...h G-E Acoustic Balancer. Newly ...eloped Pressure Equalizer . . . a ...refront shaping plug . . . provides ...both tweeter response.

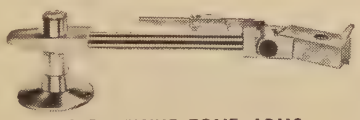


G-E POWER AMPLIFIER
Model A1-300

A medium power, compact amplifier designed to provide needed speaker power. Essential element in the new General Electric "Custom Music" Ensemble. Delivers high-fidelity performance at very low cost.

...E PREAMPLIFIER-CONTROL UNIT
Model A1-200

...mbines functions of equalized pre-...plifier plus adjustable record com-...isation, program input selection, ...e controls and volume control. ...tching unit for the "Custom ...sic" amplifier. Self-powered for ... with any installation.



G-E *DELUXE* TONE ARMS
A1-500 (12″) **A1-501 (16″)**

For home or broadcast station use. Compatible with the exceptional quality of G-E cartridges. Calibrated stylus pressure adjustment . . . 4 to 14 grams. They were developed to improve record reproduction in every installation.

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LOW COST...MINIMUM SERVICE...
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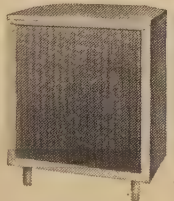
G-E SPEAKER ENCLOSURE
Model A1-406 (6 cu. ft.)

...tractive corner or wall cabinet in ...nd-rubbed blond or mahogany ...neers. "Distributed port" design ...ovides full low frequency response. ...nal range with G-E Coaxial ...eaker—40 to 15,000 cycles.



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ground along with the desired sig even though the receiver is tuned a frequency far removed from broadcast station's. To eliminate effect, decrease the capacity in antenna trimmer condenser. This denser also helps take out any "d spots" in the tuning range caused antenna resonance effects. The ceiver tunes through the range 3.5 18 megacycles with the two coils scribed in the parts list. Other could be suitably proportioned to tend the range if desired. The No can learn much by experiment with other coils wound with the of the inductance-capacity charts other data found in the various ra handbooks.

UNUSUAL SERVICE CALL

By JAMES B. TAYLOR

THE phone rang and the voice on other end of the line asked, "Can send a serviceman out to check my vision set? The last commercial the station ran over an hour ago is on the screen."

"What?" I asked, "do you mean the station is running one comme for over an hour?"

"Oh no," replied the voice on other end, "but when they ran a tage-cheese ad about an hour ag must have been awfully strong fo stuck to my picture-tube screen stayed there. I can still see the programs through the ad, but they not clear."

Muttering to myself that somebo either drunk or crazy, I picked up service kit and headed for the ad given. What I saw can be seen in accompanying photograph. There the cottage-cheese ad as clear as would want on the screen in black, the set still working and getting a ture, except for the black portion ing masked by the ad. The only the set owner could give was tha heard a dull thud when it happene

EDITOR'S NOTE: Such an effect be due to ion acceleration in the and the resultant bombardment o screen by heavy ions. Where there large accumulation of electrons on screen (light portions of the pic there will be a great attraction fo ions, and this portion of the screen receive heavy bombardment resulti a burn on the screen. Darker por of the picture will be burned-in less lighter portions. Hence, the pi reversal effect.

TV picture tube with commercial burn onto screen due to ion bombardm

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CREI courses are prepared, and nt with an eye to the needs and de- ds of industry, so your CREI diploma pen many doors for you. Countless I graduates now enjoy important, good-paying positions with America's most important companies. Many famous organizations have arranged CREI group training for their radio-electronics-television personnel. To name a few: All America Cables and Radio, Inc.; Canadian Aviation Electronics, Ltd.; Canadian Broadcasting Co rporation; Columbia Broadcasting System; Canadian Marconi Company; Hoffman Radio Corporation; Machlett Laboratories; Glenn L. Martin Company; Magnavox Company; Pan American Airways, Atlantic Division; Radio Corporation of America, RCA Victor Division; Technical Appliance Corporation; Trans-Canada Air Lines; United Air Lines. Their choice for training of their own personnel is a good cue for *your* choice of a school.

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MAKE YOUR ELECTRONI FLASH MORE VERSATIL

By E. Q. PROCTOR

Simple circuit changes, incorporating a means of varying t light intensity, will make your flash equipment more use

"THE greatest light output per dollar" is the rule generally followed by the prospective purchaser or constructor of electronic flash equipment. Frankly, this rule is hard to beat if the unit is to be used for general purpose shooting; the slow speed of color films and those long shots in black and white make it mandatory. On the other hand, this high light intensity can be something of a disadvantage under certain circumstances.

A large percentage of the flash equipment that is bought or built by the average amateur has only one flash bulb which is usually mounted on the camera. Used in this manner, the photographer may find that he has *too much* light for shots under eight or ten feet. As an example, a typical 60 to 100 watt-second unit will have a light output sufficient to give an exposure guide number in the vicinity of 160 with a certain film. This means that at 10 feet, the camera lens aperture should be set at *f*16; at 7 feet, *f*22; at 5 feet, *f*32; and at 3½ feet, *f*45. Trouble arises at these distances if the camera lens aperture can not be reduced beyond *f*16 or *f*22 because there aren't any markings beyond that point.

Actually, very few miniature camera lenses have markings beyond *f*22, the markings on press-type camera lenses usually stop at *f*32, and *f*45 is generally found only on long focal length portrait and view camera lenses. As a result, the average amateur photographer, attempting to take a close-up of "little Peggy" to send to her doting grandparents, may find that he has to resort to undesirable gadgets such as a filter over the lens, a handkerchief hung over the flash tube, or some other means to reduce the effect of that brilliant flash of light.

The obvious solution to this problem is to have a means whereby the light intensity may be varied to suit the needs of different lighting requirements. While a few manufacturers have this feature incorporated in one or two of their models, I do not recall having seen it presented in an article on constructing flash equipment. I constructed a single flash unit several years ago with variable light output included in the design, and the variability has been a very useful innovation.

The principle of the variable fe is quite simple, and so is its cons tion: With a given operating vo the light output of a flash unit termined by the capacity of the age condensers used; that is, the capacity, the more light output the power limit imposed by the tube. Therefore, in units that em more than one storage condense light output can be varied by m of a switching arrangement whi lows all or just part of the cond to be switched into the circuit. exact switching arrangement used will depend largely on the ber of condensers employed an best be determined by the needs user. Preferably, it should be inc in a unit's design before constru however, it may readily be porated in existing equipment tha more than one condenser and in space for the switch is availabl

In the case of a unit that has two condensers, such as the or scribed in the March 1953 iss RADIO & TELEVISION NEWS, all t needed is a s.p.s.t. toggle switch nected in a lead of either of the age condensers. With the swit both condensers will be in the ci with the switch off, one condense be removed from the circuit, ar power to the flash tube will be half. Toggle switches can be u this manner for any number o densers if a suitable rotary type available. My unit uses four densers, and I found, after con able searching, that one of the type electric range switches wit positions—high, medium, low, an filled the bill perfectly. In the position, one condenser is con permanently in the circuit, and succeeding step adds one more.

My experience has shown th guide number varies directly wi amount of capacity used. My u a 2000-volt power supply and use 8 μfd. oil-filled condensers whic a maximum 64 watt-seconds c Using film with an ASA rating and with all four condensers sw into the circuit, a guide number gives very good results with mended film development. By only three of the four condense guide number is reduced to 12

RCA *INTERMATCHED* HIGH FIDELITY

. . . to assure you of HIGH FIDELITY EXACTLY AS YOU WANT IT

Now—from RCA—comes the ideal way to achieve *exactly what you want in high fidelity*. You can be confident of top quality—every component in your system bears *the name you know best in electronics.*

For extra assurance—RCA offers a broad selection of components—all designed for top performance in their class—all *intermatched* to work together, regardless of the combination you choose.

Listen to the full line of RCA *Intermatched* high-fidelity components, look at the distinctive cabinet styles, and make your choice. You'll have a completely matched system that's right for your home and your taste in high fidelity. You'll have a complete system that you can assemble in minutes, with just a screwdriver. And you'll be prepared at any time to add more power or extra coverage—if you feel you need them—without mismatches at any stage.

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RCA INTERMATCHED CHANGER

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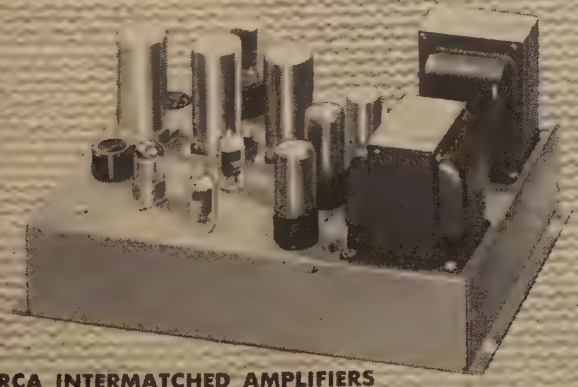
RCA INTERMATCHED PREAMPLIFIER



RCA INTERMATCHED AMPLIFIERS

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half the condensers in use, the guide number of 160 is halved; and with one condenser, the number is 40. This wide variation in available light has many possibilities including not having to stop the lens down when great depth of field is undesirable, not having the flash "swamp" the main light when using it as a fill-in light, etc.

Care should be used in selecting the switches to be certain that they will handle the high momentary current surges and that their insulation will not break down under the voltage employed. When my unit was under construction, I had on hand a 3-gang ceramic bandswitch; and with some misgivings, I connected it in the circuit. After a little use, my doubts were confirmed: the contacts on such a switch just couldn't take the heavy current surges and the arcing involved in switching uncharged condensers into the circuit. Spring-loaded switches that make contact quickly and positively are the best types to use. Otherwise, slow making and breaking will result in arcing between contacts and will shorten the life of the switch.

As a precaution against breakdown, switch contacts should be connected in the condenser lead that would normally be connected to the grounded side of the power supply. *The shafts and toggle handles of the switches should also be grounded to the chassis in such a way that, should a breakdown occur, the high voltage can not reach the operator.*

In any unit having switches included as described, all condensers should be connected into the circuit before the power is turned off to allow the condensers to be discharged in a normal manner through the unit's bleeder system. —30—

International Short-Wave

(*Continued from page* 82)

Burma—Rangoon, 4.750A, becomes audible in Australia 1000 and closes 1020. (Williams)

Canada — Reports for the CBC should be addressed to Box 6,000, Montreal, Quebec, Canada. (*WRH*, others) VED, 7.32, Edmonton, Alta., noted recently 1830 with classical music, fair level but bad QRM. (Bellington, N.Y.) CHNX, 6.130, Halifax, N. S., has "Hobby Program" Thur. 1530-1545. (Grace, Conn.)

Ceylon—Radio Ceylon's Commercial Service sent letter-veri for 11.975 and listed India beam in *English* 2030-2330, 15.120, 9.520; 0730-1230, 11.975, 9.520; in Hindi 2030-2300, 0830-1130, 7.190. (Pearce, England) Heard on 6.006 at 0730 with music, commercials. (Sanderson, Australia)

Chile — CE1515, 15.15, Santiago, noted in Spanish 2100.

China—Radio Peking is seldom audible for *English* session 0830 on 15.06, 11.69A, but the Home Service is good then on 10.20, 10.26, 9.04, 7.50. 6.20. (Balbi, Calif.)

Colombia—The *new* Colombian on

identifies as "Radiofonica Co-a;" opens around 0600; strong in Australia. (Cushen, N. Z.; Hut- Australia)

ta Rica—Radio Crystal, TIHBG, San Jose, sent letter-veri; listed ule of 0745-2400. (Pearce, Eng-

ba—The Cuban which has been -ing VLC9, 9.615, Australia, ings (*EST*) may be COJK, moved 8.663. (Stark, Texas)

prus—Sharq-al-Adna, 6.790, Li-pl, noted 1255-1335 in Arabic; has in Arabic 1330. (Arvidsson, en) Heard on 9.650 with call in ic 1115 followed by slow-speed in that language. (Pearce, Eng-

echoslovakia—OLR3A, 9.55, Pra- noted in *English* to North Amer-0930-2000. (Zerosh, Pa.) And at 2330, announcing "This is the e of Peace from Prague." (Mor- Pa). A letter from a station of-s says will be glad to answer re- s and questions during the "An- s to Listeners" session 2300 Sat.; musical half hour Sun. 2300-2330. d, Iowa) Heard on 9.504 with *ish* from 1400 sign-on. (Pearce, land) Uses this channel for *Eng-*now 0715-0745. (ISWC, London)

nmark—Copenhagen's OZF, 9.52, d with DX session on Tue. around) (Crowell, Pa.) And repeated A. (Ferguson, N. C.) *Tests* for nland on this channel noted daily -2000. (Boyce, N. J.)

minican Republic—HIIZ, 6.115A, ad Trujillo, is showing up with g signal around 1830; at times "Emisora Nacional" as well as Voz de Muchachos." (Niblack, HI2T, 9.727A, noted 2125 with ish, fine level in Michigan. (Horn-)

tch New Guinea—Word from *o Omroep Nieuw Guinea,* Hol-ia, indicates that the station will moved at the end of this year to , one of the Schouten Islands, re a *new* studio and a 5 kw. trans-er will be put into service. Present dule on 7.126 was listed 0430-0700 ; Thur. 0400-0700; Sat. 0430-0730; there is a special transmission -2300, Sat. at 2100-2300; present er is 350 watts. (Scheiner, N. J.) rd lately in Australia on 5.045 at -0630 closedown. (Williams) Is allel with 7.126 and usually has s in Dutch 0500. (Cushen, N. Z.)

cuador—By this time, transmitters HCJB, Quito, "The Voice of the es," should have been moved to where it is expected signals will nuch improved. *Wants reports.*

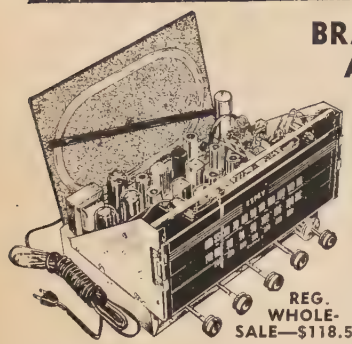
C1BF, 4.750, *Radio Commercial,* to, noted with dance music, Span-identification 2200 to 2300 sign-off; level. HC1FM, 6.830, *Radio Equi-cial,* Ibarra, heard with dance mu-2200, weak, CWQRM. (Hardwick, Z.)

gypt—Cairo has been *testing* one its *new,* powerful transmitters obably 100 kw.) on 9.615, heard

(*Continued on page* 134)

OLSON'S PENNY PROFIT POLICY MEANS GREATER BARGAINS

BRAND NEW 14-TUBE ESPEY AM-FM RADIO CHASSIS



- 13 WATTS PUSH-PULL OUTPUT
- 6-GANG TUNING CONDENSER
- PRE-AMP STAGE FOR VR PICKUP

REG. WHOLESALE—$118.50

Custom Buy of 1953

OLSON SPECIAL Stock No. RA-150 $69.95

Olson comes through again with quality-plus at an unbelievable bargain price—It's the Brand New World-Famous Espey Superheterodyne AM-FM Receiver that wholesales for $118.50. With our low price you save $48.55. How can we offer such an amazing bargain? We simply bought all the manufacturer had in stock—at our price.

Features: New, Improved FM Circuit—Drift Compensated. 14 Tubes—5 dual purpose—thus gives 19-Tube Performance. Treble and Full Range Bass Tone Controls. Automatic Volume Control. Built-in AM Loop and FM Folded Dipole Antennas and provision for external antennas. Pre-Wired for high and low impedance pick-ups. AM and FM Circuits include Tuned RF Amplifier stages and interference-free Ratio Detector Circuits. Tuning Ranges: AM-535 to 1720 Kc, FM-88 to 108 Mc. Large easy-to-read "slide-rule" dial. Multi-tap (2, 8 and 500 ohm) output transformer will match any popular Hi-Fi Speaker such as 12" Co-Axial below. High Fidelity assured by use of RCA and Hazeltine licensed circuits and highest quality parts throughout.

Amplifier tube. 1 AM Oscillator, Mixer tube. 1 IF Amplifier tube. 1 FM Detector Driver tube. 1 FM Detector tube. 1 FM Oscillator tube. 1 FM Mixer tube. 1 AM Detector, Audio Amplifier tube. 1 Audio Amplifier-Inverter tube. 2 Push-Pull Power Amplifier tubes. 1 Rectifier tube. 1 Pre-amp Pickup tube. 105/125 V.; 50-60 cycles—Chassis Size: 13½" wide x 8½" high x 10" deep. Factory-Sealed Cartons. Shpg. wt. 20 lbs.

12" CO-AXIAL SPEAKER

$12.95 Stock No. S-168

Our new 1953 Model. Guaranteed to outperform any speaker in its price class. Equipped with two "high concentration" Alnico 5 magnets and a high frequency diffuser. The 12" section delivers the bass while the inner 3" tweeter speaker section delivers the treble tones. Together they give you "living tone." This speaker is unconditionally guaranteed to satisfy even the most critical user or Olson promises to refund your money. Only two wires to connect to any radio or amplifier. Voice coil impedance 8 ohms. Frequency response 30 to 17, 500 cps. Ship. wt. 10 lbs.

10 WATT HI-FI PUSH-PULL AMPLIFIER

- Built-in Pre-Amplifier
- G-E Cartridge Input
- Treble and Bass Boost
- All-Aluminum Chassis
- Push-Pull Output
- Multiple Speaker Impedances

$32.95 WITH TUBES Stock No. RA-102

Bombshell Value! It's unbelievable. A full 10 watt Hi-Fi Amplifier, completely assembled and ready to play. Has built-in PRE-AMP for G. E. and similar types of magnetic pickups. 4 Inputs: 1 crystal phono, 1 magnetic phono, 1 radio, 1 mike. 4 Controls: 1 Bass, 1 Treble, 1 Volume, 1 Phono-radio Switch. Output Impedances: 4, 8, 16 ohms. Peak Power output 17 watts.

Order this amplifier today and see what brilliant, realistic tone it will deliver. Supply is limited. Everyone in factory sealed carton. You couldn't buy the parts alone for this price. Remember this is a full size amplifier, transformer operated, not an AC-DC job. Frequency response 30 to 20,000 cps at less than ½ of 1% distortion. 5 Tubes: 1—6SL7, 1—6SC7, 2—6V6, 1—5Y3. Complete with tubes. Size 12" x 6" x 5½". Shpg. wt. 15 lbs. Can be used with any phono or speaker but you should take advantage of the Combination Deal offered below.

COMBINATION DEAL!

10 WATT HI-FI PUSH-PULL AMPLIFIER COMPLETE WITH 12" CO-AXIAL SPEAKER

Stock No. AS-67

Both for Only **$39.95** WITH TUBES

Completely wired. Not a kit.

This is the best matched Amplifier-Speaker Deal in America Today. You get the 10 Watt Hi-Fi Amplifier as described above PLUS the 12" Co-Axial Speaker—also as described above. Can be built into any cabinet or bookcase, giving you a complete amplifier system you will be proud to own and show to your friends. Look at our Amazing Low Price—and Order Today. Shpg. wt. 25 lbs.

FAMOUS V-M Tri-O-Matic RECORD CHANGER with SHURE TURN-OVER CRYSTAL CARTRIDGE

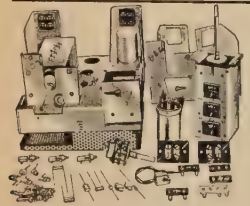
STOCK NO. RA-149

$26.95

BRAND NEW—FULLY AUTOMATIC 3-SPEED—33⅓, 45, 78 R.P.M. PLAYS ALL 7, 10, 12" RECORDS

Olson offers for the first time one of the most popular changers on the market today—at a brand new super low price. Here's your chance to get that V-M changer you've been wanting at the price you've been waiting for. Makes ideal changer for above amplifier, speaker and radio. 100% Automatic. Motor shuts off after last record is played. Handles twelve 10" or ten 12" (33⅓ or 78's); twelve 7" (33⅓ or 45's). Same speed records may be intermixed. Reg. Price $46.50. Mtg. Ctrs.—14½" W, 12¼" D, 5¾" above and 2¼" below plate. Full instructions. 105/125 V., 60 cycle AC. Factory Sealed Cartons. Shpg. wt. 12 lbs.

AMAZING DUMONT KIT OF PARTS



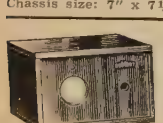
STOCK NO. AS-90

$3.99

MALLORY INDUCTUNER Plus Over 24 VALUABLE BRAND NEW PARTS

Olson gives you the most colossal bargain ever offered servicemen and experimenters. It's the big basic Kit of Parts for the FAMOUS DUMONT RA-146 TV Booster. Because we couldn't get the diagrams and some of the parts—we are able to make this terrific offer. Included are the basic parts for building an FM or TV Booster, a preselector to remove unwanted signals or interference, a 2-meter Ham receiver, a signal generator, and for experimenting. Includes punched chassis, bottom plate, 3-gang Mallory Inductuner (52 to 216 Mc), multiple section electrolytic filter condenser, combination AC and DPDT switch, 3 silver plated VHF coils, 3 low loss feed through air-trimmers, resistor, 5 silver mica and ceramicon condensers, 2 chokes, panel lamp socket, mounting panels, terminal boards, tie strips and assembling hardware. All Brand New—Fully Guaranteed. All Standard parts for general servicing. Chassis size: 7" x 7½" x 1½". Shpg. wt. 6 lbs.

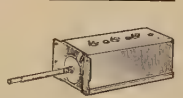
DUMONT TV BOOSTER CABINET



STOCK NO. K-62 **$1.99**

Handsome mahogany finish cabinet for the outfit described above. Bottom drilled to fit chassis. Front openings match switch and tuner shafts. Makes Deluxe cabinet for boosters, amplifiers, tuners or receivers. Size 9" x 9" x 6". Shpg. wt. 5 lbs.

Reg. $15.00 Mallory Spiral Inductuner



STOCK NO. X-337 **$2.99**

The heart of the above Dumont TV Booster. A 3-gang variable inductance tuning device to provide efficient front-end tuning in deluxe TV and FM receivers and boosters. Makes a perfect unit for building 2 meter receivers. Covers entire range 52 through 216 mc. Shaft 2½" long, ¼" dia. 6 turns covers band. Size: 4-11/16" x 2" x 2⅛". Shpg. wt. 3 lbs.

SAVE MONEY ON FAMOUS SPEED WAY POWER TOOLS

REG. $19.50

$14.95 STOCK NO. TL-24

¼" ELECTRIC SPEED DRIL

Equipped with keyed Jacobs chuck; Po 125 watts output at chuck; Capacity: in steel, ½" in wood; Full load speed: R.P.M. Lightweight—yet packs terrific p and speed. Die-cast aluminum case chassis with cast-in air cooling sys Self-aligning, oilless bearings with felt s Ball thrust bearing. Trigger switch and —releases instantly. Built-in spindle for easy chuck release. Specially w high torque Speed-Way universal m (115 V. AC-DC). The perfect drill fo repairman, hobbyist, mechanic, etc., a Olson Bargain Price. Shpg. wt. 8 lbs.

½" SPEED WAY ELECTRIC SPEED DRIL

STOCK NO. TL-25

$29.95

REG. $39.50

Keyed Jacobs chuck; ½ H.P. Universal M 600 R.P.M. Free Running Speed; 110-120 V. DC. U.L. Approved. Today's greatest ½" value. Lightweight yet built for speed and po Has all the features of the ¼" drill and some. Alloy steel cut gears. Heavy thrust ing enclosed and sealed for life. Removable handle formed to hand. Inline breast plate Shpg. wt. 16 lbs.

SPEED WAY PORTABLE HAND SA

Convert Your Electric Drill Into a Portable Power Saw, Only.....

REG. $5.95

$4.50 STOCK NO. TL-30

Olson now helps you take the work out of hand sawing for little cost. T 2 tools out of your ¼" electric drill. Hand Saw is light-weight—only lbs. complete. Easy and safe to use on any trimming, rip or cro sawing, and dado cutting. 4" saw blade cuts to 1". Oilite bronze bea some. Alloy steel cut gears. Heavy thrust Direct drive—no gears to get out of order. ¼" dia. shank for fitting electric drill chuck or flexible shaft. One-piece cast aluminum-alloy with beautiful crackle finish. Shpg. wt. 2 lbs.

REGULAR $12.95 DRILL STAND

Easily Convert ¼" Speed Drill Into Useful Drill Press

STOCK NO. TL-31 ONLY **$9.95**

Olson offers this drill stand at a away price. Your hand drill truly universal with this sturdi structed, smooth coil spring drill stand. Now's your chan have a professional type works a tremendous saving. Simple to and operate—you can't afford t up Olson's Bargain Price. Shp 11 lbs.

SPEED WAY SPEED SA

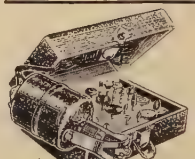
REG. $29.95

$24.95

STOCK NO. TL-28

¼ H.P. AC-DC 3500 R.P.M. adjusts at any angle from 0° t 5" blade cuts from 0" to 1⅛"; bination cross-cut and rip saw Those difficult and tedious jobs are all in the past with thi Speed Saw—Fully Guaranteed by and Speed Way. Saws both s and square, angle cuts, can rip, trim, groove or "blank-out" ings in walls or floors. Lightweight-cast aluminum housing and guards. Adjustable rip fence. Safety Thumb Switch on handle automa stops blade the instant grip is released. Don't be misled by Olson' Price—this is an outstanding quality-built tool with all the versatilit features of much higher priced models. Order from Olson and Shpg. wt. 13 lbs.

SPEED WAY GRINDER K

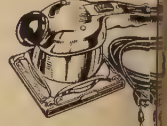


REG. $14.50 STOCK NO. TL-26 **$11.9**

Handiest tool kit ever made for the s home. Hundreds of uses, and it's price by Olson. Kit contains famous Speed Electric Hand Grinder with finger tip Super power air-cooled 20,000 R.P.M. Operates on AC or DC. Complete with both 3/32" and ⅛" coll mounted grinding stones, 4 steel cutting burrs, 3 mounted bristle b 1 wire scratch brush, 1 abrasive rubber polishing tool, 2 mandrel 12 sanding discs 1 instruction manual, all in dark blue leatherette wooden case. Shpg. wt. 4 lbs.

Speed Way Speed Sander

SANDS • SMOOTHS • POLISHES



STOCK NO. TL-27 REG. $34.50 **$27.95**

Professional model. Sands old finishes from wood or metal, or s and polishes to a "piano finish." Takes any grade of sandpaper or abr 3/16" orbital motion 110-120 V. 60 cy. air cooled AC 3450 r.p.m. direct driven. Cast aluminum body—all sealed ball bearing constr Lightweight—only 5 lbs. complete.

SPEED WAY BENCH GRIND

REG. $16.50 STOCK NO. TL-29 **$12**

110-120 Volt 60 Cycle AC (Only) 3400 R.P.M.; 4½" x 3⅜" x 3 and coarse wheels; self-aligning bronze bearings; U.L. Approved. balanced—smooth and silent running—no creeping. Lightweight—7 Rubber feet prevent scratches or may be bolted to bench. Strong cast aluminum housing with wheel guards and tool rests. Handsome finish—a must for every home or shop and a fabulous buy at Olson price. Shpg. wt. 8 lbs.

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OLSON RADIO WAREHOUSE 275-F EAST MARKET ST., AKRON 8, OH

AIL YOUR ORDER TODAY—OLSON WILL RUSH IT RIGHT AWAY!

BE CUSTOM AUTO RADIOS

our chance to save plenty on these nationally CUSTOM AUTO RADIOS. Simple to install— , no brackets, no holes to drill. Install in 3 utes. Custom-built to fit in dash of each model d. Six tubes including rectifier—2 being dual- thus you really get 8-tube performance. Dy- peaker with powerful Alnico 5 permanent Easy vision slide-rule dial. Beautiful ham- finish. Shpg. wt. 16 lbs.

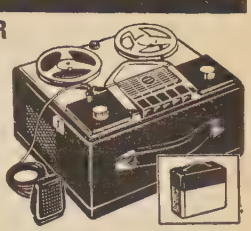
$41.97

MAKE OF CAR	YEAR MODEL
Chevrolet	1949-1950
Chevrolet	1951-52
Chevrolet	1953
Dodge	1949-1950
Dodge	1951-52
Dodge	1953
Ford	1949-1950
Ford	1951
Ford	1952

CHOICE OF ANY MODEL

STK. NO.	MAKE OF CAR	YEAR MODEL
RA-144	Ford	1953
RA-451	Hudson	'48-49-50-51-52-53
RA-751	Henry J.	1951-52
RA-143	Mercury	1952-53
RA-200	Plymouth	1949-1950
RA-651	Plymouth	1951-52
RA-125	Plymouth	1953
RA-551	Studebaker	1950-1951-1952

ONLY WILCOX-GAY Recordio TAPE RECORDER with PREST-O-MATIC push-button keyboard gives Maximum performance for Lowest cost!



DUAL SPEED—Records at 1⅞" and 3¾" per second

STOCK NO. AMP-17

$99.50

Records for 2 hours on half of a 7" reel plus another 2 hours on other half at 1⅞" per second; and at the 3¾" per second speed you can record a full hour on each half of a seven-inch reel. 80-6000 CPS.

This is the famous DeLuxe Wilcox-Gay Recorder that retails all over the country for $159.95. Naturally they are all brand new, in factory sealed cartons and Guaranteed 100% by Wilcox-Gay and Olson.

How can we sell this outstanding value for such an amazing low price?

The answer is simple . . . our main purpose in this business is to offer the highest quality for lowest cost . . . and the Recordio is a perfect example.

Record those treasured "Family Highlights" . . . or your favorite music, broadcasts, friends or parties. Use it in your business for dictation, meetings, speeches, etc. Portable Recordio is also a valuable aid in Schools, Churches, and Clubs.

Remember . . . it's completely Automatic . . . the finger-tip controls are so simple even a child can operate it. And we're offering the finest Recorder we've ever featured at LESS than Dealer's Cost.

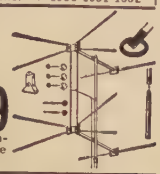
INSTANTANEOUS RECORDING OR PLAYBACK. 2-SPEEDS. RECORDS, PLAYS BACK, ERASES. LOOK AT THESE QUALITY-PACKED FEATURES: Five "Prest-o-matic" Controls allow instant choice of all operating functions . . . high speed forward and reverse, record, stop, and playback. Handles up to 7" reels. Neon Indicator shows Normal and Overload levels. Full Range Variable Tone Control allows maximum brilliance to a deep, rich bass tone. Volume Control bass and treble compensated for best reproduction. COMPLETE . . . READY TO OPERATE. Included: Weatherproof Controlled Reluctance Microphone. Radio . . . Phono . . . TV Input Jack permits recording from radio, phono or TV speaker voice coil by means of patch cord. External Speaker Jack for external speakers automatically disconnects internal 5" x 7" elliptical P.M. Speaker. 4 Tubes . . . 6SJ7, 6AQ5, 12AX7, 6X4 Rectifier. 7 ft. Cord. Handsome Removable Cover. Operating Instructions. Size: 12" x 14" x 9" . . . 23 lbs. complete. 110-120 Volt 60 Cycle AC. U.L. Approved.

OMPLETE TV ANTENNA

lete stacked array. Made by a manufacturer whose name and on every factory sealed carton. at you get: 2 Six-element coils, 1 pair "Q" bars, 2 Five-foot ctions, 60 ft. 300 ohm twin line, off insulators, 1 mounting base, ing, 1 clamp, hardware. Elements est quality aluminum. Reg. list $31.95. Shpg. wt. 15 lbs. only.

Stock No. AU-24

$12.99 Complete Set



KIT of JFD TV LEAD-AND-OFF INSULATORS

NO. 25

25 double and single assorted d wall type insulators—reg. list 4.75. Olson's price—less than . Here's an exciting value in JFD "Snap-on" and wood ype insulators. Sizes you need never find around your shop. de, 100% rustproofed. Genuine olene insulators both double gle types for mast diameters: ¼, 1¾, 1¾, 1⅞" as well as single wood screw type. All cluded. Shpg. wt. 4 lbs.

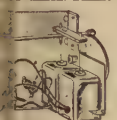
FINAL CLOSEOUT! THYRATRON CONTROLS

STOCK NO. RA-131

$1.99 LESS TUBES

Over 25 valuable parts at an average of less than 8c each. Easily worth six times this give-away price. Value packed with condensers, resistors, Variable Control, Dial Assembly, Control-Relay, Filament Transformer, Control Housing, SPST Switch, Pilot Lamp Assembly, Bottom Plate, 5 Prong Plug, etc., etc. All brand new—hundreds of uses for radios, amplifiers, and for experimenting. Shpg. wt. 5 lbs.

PERMEABILITY TUNED AM FRONT END



3 for $5.50

$1.89 EACH

BRAND NEW! PARTS ALONE WORTH $4.50. Used in standard broadcast receivers in place of variable condenser and associated parts. Self contained—includes antenna, tuned r-f and oscillator coils, dual trimmers. Designed for linear dial calibration through approximately 340° rotation by means of concentric cam and lever drive. Connects directly to mixer grid and r-f grid to make complete receiver. Mounted on plate 5¼" x 5¾". Instructions included. Shpg. wt. 1 lb.

K No. L-46

BRAND NEW PLASTIC BASE RECORDING TAPE

600 Ft. REEL: STOCK NO. X-275 Single ea. $1.49 Lots of 10 $1.29 each

1200 Ft. REEL: STOCK NO. X-249 Single ea. $2.19 Lots of 10 $1.99 each

Get the buy of your life. Save up to 64% on high quality RECORDING TAPE. A large manufacturer had to sell his inventory and he unloaded the whole deal. Olson now offers you this high grade fully guaranteed recording tape at prices which defy competition. Standard ¼" wide, 600 and 1200 ft. lengths. Frequency response 50 to 8,000 cy. Plastic Reel included with each. Shpg. wt. ea. 1 lb.

RELAYS

CHOICE—ONLY $1.99 EACH

STOCK NO.	CONTACTS	OHMS	USE
SW-30	SPDT	30	6 to 12 V.
SW-41	SPST	3000	Plate Sens.
SW-24	SPST	5000	Plate Sens.
SW-29	DPDT	6000	Plate Sens.

Made by Allied and Potter-Brumfield. Silver contacts. Size: 1¼" x 1½" x 2". Shpg. wt. each 1lb.

DELUXE COUNTER

STOCK NO. X-298

$1.69

We're letting these go at a fifth of Actual Cost—$8.50. Keep an accurate count up to 100,000 on transactions, traffic, production, etc. Just touch a lever and it counts. Shpg. wt. 1 lb.

4-PIECE PLIERS and WRENCH SET

STOCK NO. TL-32

$3.79

Handiest of all Kits for the repairman and hobbyist—at the lowest price ever. Set includes 7" Linesman's Pliers, 5-3/16" Long Nose Pliers, 5-3/16" Diagonal Cutters and 6" Adjustable Wrench. These quality tools are made of finest drop forged steel with ground and polished heads. Cutting blades carefully hardened and tempered to hold a keen, sharp edge. Complete with plastic pouch with eyelets for hanging and See-thru pockets for tools. Shpg. wt. 2 lbs.

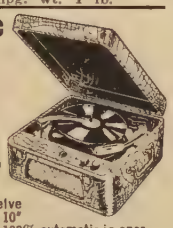
RCA TV LINE COUPLER

Stock No. RA-132

$1.99 EACH

Made by RCA and used on their production lines. Copper Case 3½" x 3½" x 2", fully with built-in deck and removers; 2 amphenol silver plated lugs; 1—RCA 6J6 tube, socket 3—.1 mfd. 400 volt tubular rs; 2 mica condensers; 5 re- ladder, choke and slug tuned g. wt. 3 lbs.

3-SPEED AUTOMATIC PORTABLE RECORD PLAYER



Complete With Latest Model VM Changer, Amplifier, Speaker and Portable Carrying Case.

STOCK No. RA-145 $45.95

Regular $84.50. Changer plays twelve 7" discs (33⅓ or 45 RPM); twelve 10" or ten 12" discs (33⅓ or 78 RPM). 100% automatic in operation. Just stack on the records. Motor shuts off after last disc. Turnover cartridge for playing all speeds. Two osmium tipped long life needles. Alnico 5 PM heavy duty speaker. Volume and tone controls. Simulated Alligator case 17 x 15 x 8". 115V. 60 cy. AC. Factory sealed cartons. Shpg. wt. 21 lbs.

PRICES SLASHED TO BITS ON OLSON RESISTOR KITS

GIANT "SUPER-ASSORTMENT" KIT—232 RESISTORS

Olson Offers You a Price-Busting Assortment of Brand New, Fully Guaranteed Most-Popular Resistors At the Lowest Price in Our History. Without a doubt this is The Biggest Resistor Bargain to be found in America Today. Every Kit is chuck full of Popular Values—sizes you need and use every day in TV and Radio Servicing. Invaluable to hams and experimenters. Many leading brands of resistors are included such as IRC, Clarostat, Centralab and other top-notchers. KIT CONTAINS: 200—½ Watt Resistors, 20—1 and 2 Watt Resistors, 12—5 to 25 Watt Wirewounds. A total of 232 Assorted Popular Resistors worth at least $23.50. Every Kit is unconditionally guaranteed to please or you get your money back. Every Resistor is RMA Color Coded or stamped with value. Tolerances are 5%, 10% and 20%. This amazing offer will not be repeated when our stock is gone. Shpg. wt. 2 lbs.

$3.95 STOCK No. AS-84

24 DRAWERS

12½" High, 12½" Wide, 6" Deep
72 COMPARTMENTS
STOCK NO. X-334
SINGLE. Ea. $7.95
LOTS OF 3, EACH $6.95

48 DRAWERS

22½" High, 12½" Wide 6" Deep
144 COMPARTMENTS
STOCK NO. X-335
SINGLE, EA. $15.95
LOTS OF 3, EACH .. $13.95

BRAND NEW ALL-METAL PARTS CHESTS

Olson gives you a chance to load up on these famous make Parts Chests for less than HALF THEIR REGULAR PRICE. Case is heavy, welded Dura-Steel, strong and sturdy with handsome grey enamel finish. Drawers are ALL-ALUMINUM—1¼" deep, 2¾" wide, 5¾" long. Each drawer has 2 removable sliding partitions. Index cards provided for insertion in card holder on front of each drawer.

Order your share while they last. Keep all those small things handy—such as Nuts, Bolts, Screws, Small Parts, Condensers, Resistors, etc. Chests may be assorted for quantity price. Shpg. wt. X-334, 9 lbs.; X-335, 18 lbs.

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Olson's LOWER-than wholesale prices from this famous STANDARD BRANDS—FRESH STOCK. IMMEDIATE DERY. Catalog is two colors—40 full pages of unbelievable ins. A new catalog mailed Bi-Monthly—with new low ins each mailing. Simply note on your order or write for your free copy from: OLSON RADIO WAREHOUSE, EAST MARKET ST., AKRON 8, OHIO.

IT'S EASY TO ORDER FROM OLSON'S

How to order: Order directly from this ad. State quantity desired, stock number, description and price. You may send remittance with order. (Add for Postage: Estimate at least 5c for each $1.00 of order value,—10c for each $1.00 if you are more than 1,000 miles away. We refund every cent not used) or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

MONEY BACK GUARANTEE: Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund.

Please Minimum Order $3.00

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WE SHIP SAME DAY WE GET YOUR ORDER

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL

NAME _____ TOTAL

ADDRESS _____ ADD POSTAGE

CITY _____ ZONE ____ STATE ____ TOTAL AMOUNT

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live in or near either of these cities visit our Bargain Stores where find these and hundreds of other Olson Buys.

OLSON AKRON OLSON RADIO WAREHOUSE 275-F EAST MARKET ST., AKRON 8, OHIO

NEW TV STATIONS ON THE AIR

(As of September 25, 1953)

The following new stations bring the lists published in previous issues up to date.

STATE, CITY	STATION	CHANNEL	FREQUENCY RANGE (IN MC.)	VIDEO WAVELENGTH (IN FT.)	VIDEO POWER* (IN KW.)
Florida					
Panama City	WJDM-TV	7	174-180	5.61	10.5
Pensacola	WPFA-TV	15	476-482	2.06	21
West Palm Beach	WIRK-TV	21	512-518	1.92	24
Kentucky					
Louisville	WKLO-TV	21	512-518	1.92	230
Maine					
Portland	WPMT	53	704-710	1.4	22
Massachusetts					
Cambridge	WTAO-TV	56	722-728	1.36	21.5
Michigan					
Battle Creek	WBCK-TV	58	734-740	1.34	20.5
Lansing	WILS-TV	54	710-716	1.38	25.5
Missouri					
Kansas City	KMBC-TV[1]	9	186-192	5.25	30
Kansas City	WHB-TV[1]	9	186-192	5.25	30
Montana					
Butte	KOPR-TV	4	66-72	14.6	18
Butte	KXLF-TV	6	82-88	11.8	2
New York					
Buffalo	WBES-TV	59	740-746	1.33	21.4
Ohio					
Dayton	WIFE	22	518-524	1.9	254
Oklahoma					
Oklahoma City	KLPR-TV	19	500-506	1.96	260
Pennsylvania					
Wilkes-Barre	WILK-TV	34	590-596	1.67	250
South Carolina					
Columbia	WNOK-TV	67	788-794	1.25	93.5
Texas					
Houston	KNUZ-TV	39	620-626	1.58	89
Longview	KTVE	32	578-584	1.7	20
Waco	KANG-TV	34	590-596	1.67	5
Virginia					
Harrisonburg	WSVA-TV	3	60-66	16.06	100
West Virginia					
Charleston	WKNA-TV	49	680-686	1.44	221
Wisconsin					
Milwaukee	WOKY-TV	19	500-506	1.96	240

*From Station CP application. [1]Share time on air. The frequency of th video carrier = 1.25 + channel lower freq. limit.
Total number of television stations now on the air: 261 (84 of which are u.h.f.

A TRANSISTOR BRIDGE NULL DETECTOR

By LOUIS D. CARCANO

IMPEDANCE bridges and capacitance bridges which employ headphones for null detectors, offer good opportunity for transistorization. A visual null indicator is more convenient than a pair of "cans." Null detector circuits using vacuum tubes, however, are inconvenient because of long warm-up time, and require a separate power supply.

The transistor circuit shown requires no waiting after it is turned on and takes all its power from the 6-volt battery usually included in the impedance bridge.

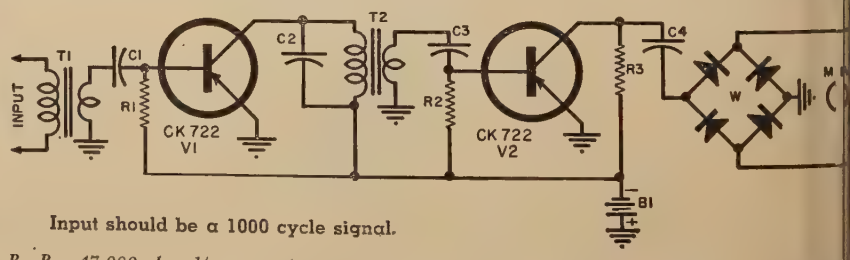
The circuit consists of two grounded-emitter stages using junction transistors, and a rectifier and a microammeter. Sensitivity is not quite as great as with headphones, but was found to be adequate.

The input impedance is about 20.(ohms. Ordinary midget output tr formers make satisfactory interst coupling units. Transformer T_2 is tu to 1000 cycles with a condenser C_2. value of C_2 will vary with the partici model of transformer, but should around .002 to .005 μfd.

The second stage should overload before the meter goes off scale. C load level depends on the emitter current, which is determined by res R_2 for any particular battery volt R_2 may require adjustment for the ticular transistor used. A more sens microammeter can be used if R_2 i creased accordingly.

—30—

Circuit of a bridge null detector which uses two CK722 "p-n-p" junction transistors.



Input should be a 1000 cycle signal.

R_1, R_2—47,000 ohm, ½ w. res. (see text)
R_3—4700 ohm, ½ w. res.
C_1, C_3—.5 μfd., 200 v. cond.
C_2—See text
C_4—.25 μfd., 200 v. cond.
T_1, T_2—Output trans., 1500 ohms to 3 ohms
W—Bridge instrument rectifier or four g manium diodes connected in bridge circuit
M_1—0-500 microampere meter
B_1—6 volt battery
V_1, V_2—CK722 "p-n-p" junction transis (Raytheon)

BUY DIRECT AND SAVE

Sweeping the Country!

'PRE-FAB' **COLLINS** TUNERS and RECEIVERS

AUDIO PRODUCTS CO.

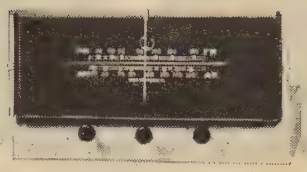
's Audio Products Co. is in no way
ffiliated with Collins Radio Co.

Two ALL NEW Complete Kits for Every High-Fidelity Need

M Tuner Kit **$55**

e FM-11 tuner is available in kit form with
IF Amplifier mounted in the chassis, wired
d tested by us. You mount the completed
Tuning Unit and power supply, then after
me simple wiring, it's all set to operate.
tubes: 6J6 RF amp, 6AG5 converter, 6C4
cillator, 6BA6 1st IF, (2) 6AU6 2nd and 3rd
(2) 6AU6 limiters, 6AL5 discriminator,
AL7-GT double tuning eye, 5Y3-GT rectifier.
ensitivity 6 to 10 microvolts, less than ½ of
% distortion, 20 to 20,000 cycle response
ith 2DB variation. Chassis dimensions: 12½"
ide, 8" deep, 7" high. Illustrated manual
pplied. Shipping weight 14 lbs.

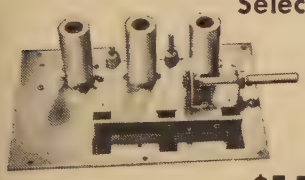
Each Collins Tuner Kit is complete with punched chassis, tubes, power transformer, power supply components, hardware, dial assembly, tuning eye, knobs, wire, etc., as well as the **completed** sub-assemblies: FM tuning units, AM tuning units, IF amplifiers, etc., where applicable. Since all these sub-assemblies are wired, tested and aligned at the factory, Collins Pre-Fab Kits are easily assembled even without technical knowledge. The end result is a fine, high quality, high fidelity instrument at often **less than half the cost** — because you helped make it and bought it direct from the factory. Bring your present reproducing system up to date with a new Collins Tuner.



FM/AM Tuner Kit **$77.50**

The original 15 tube deluxe FM/AM pre-fab kit redesigned on a smaller chassis. The tuner now measures 14" wide by 12" deep by 7½" high. This attractive new front and dial assembly opens up new applications where space is at a premium. Kit includes everything necessary to put it into operation—punched chassis, tubes, wired and aligned components, power supply, hardware, etc. Kit comprises FMF-3 tuning unit, IF-6 amplifier, AM-4 AM tuning unit, magic eye assembly and complete instructions. All tubes included. Shipping weight 19 lbs.

Selected Basic Components For Special Applications



FMF-3 Tuning Unit **$15.25**

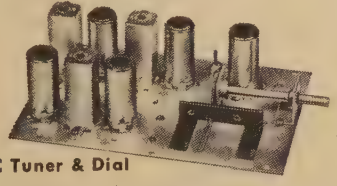
The best for FM. The most sensitive and most selective type of "front end" on the market. 6 to 10 microvolts sensitivity. Image ratio 500 to 1. 6J6 tuned RF stage, 6AG5 converter, 6C4 oscillator. Permeability tuned, stable and drift-free. Chassis plate measures 6½"x4½" In combination with the IF-6 amplifier, the highest order of sensitivity on FM can be attained. Tubes included as well as schematic and instructions. Draws 30 ma. Shipping weight FMF-3: 2½ lbs. Dial available @ $3.85

IF-6 Amplifier **$19.75**

A remarkable value! 6 tubes are used in the IF amplifier: 6BA6 1st IF, (2) 6AU6 2nd and 3rd IF's, (2) 6AU6 limiters and 6AL5 discriminator. High gain, wide-band response (200 KC) for highest fidelity. 20 to 20,000 cycles. Distortion less than ½ of 1%. Draws 40 ma @ 220 volts. Chassis plate dimensions: 11-5/16"x2½" Shipping weight: 3 lbs.

AM-4 Tuning Unit **$24.50**

Tops in AM superhet performance! A 3-gang tuning condenser gives 3 tuned stages with high sensitivity and selectivity. Assembly is completely wired, tested and aligned ready for immediate use. Frequency coverage 540 KC to 1650 KC at a sensitivity of 5 microvolts. Tubes 6BA6 RF amplifier; 6BE6 converter; 6BA6 IF amplifier and 6AT6 detector. Draws 30 ma @ 220 volts. Mounts on a chassis plate measuring 4"x7⅜". Shipping weight 2½ lbs. Dial available at $3.85.



RD-1C Tuner & Dial **$28.50**

The COLLINS RD-IC FM tuner chassis is unique in the field. A whole, compact FM tuner and dial that fits in the palm of your hand. Convert AM sets to FM/AM receivers for only a few dollars! Unlimited applications where space is at a premium. Use in conjunction with your phonograph amplifier. Full frequency response to 20,000 cycles. Sensitivity 20 microvolts, permeability tuned. Tuning unit and IF amplifier on the same chassis plate. Draws 40 ma @ 100 volts. Tubes: 6AG5 converter, 6C4 oscillator, (2) 6AU6 IF amplifiers, 6AL5 in new ratio detector circuit Shipping weight tuner and dial 5 lbs

MAIL COUPON TODAY

To: Collins Audio Products Co. Inc.
P.O. Box 368, Westfield, N. J.
Tel. WEstfield 2-4390

☐ FM Tuner Kit ☐ FM/AM Tuner Kit ☐ Slide Rule Dial Assembly
☐ FMF-3 Tuning Unit ☐ IF-6 Amplifier ☐ RD-IC Tuner and Dial
☐ AM-4 Tuning Unit

NAME.....

ADDRESS.....

CITY.....STATE.....

Amount for Kit $..... See weights, add shipping cost $.....

Total amount enclosed $..... Check ☐ Money Order ☐

WHEN YOU THINK OF TUNERS, THINK OF COLLINS AUDIO PRODUCTS

International Short-Wave

(*Continued from page* 129)

1215-1630 to Europe with calls in *English,* French every quarter-hour, followed by a tone of 1000 cycles; *reports requested.* (*Radio Sweden, WRH,* others) The 11.815 outlet which carries mostly *English,* French seems to close daily now 1700, but the Arabic session on 11.965A, 6.085, in parallel, runs later. (Pearce, England, others)

El Salvador—YSS, 9.55A, *Radio Nacional,* San Salvador, noted with uninterrupted classical music 2235 to identification at 2300 closedown. (Powers, Ohio)

England—To observe its 25th anniversary, the BBC is now conducting a contest among listeners, to determine what programs have been enjoyed most. (Bellington, N. Y.)

The Standard Frequency Station, MSF, Rugby, appears to be using 2.500, 5.000, 10.000 *continuously* 24 hours a day now. Callsign in slow Morse code and speech announcements are given at the 14th minute of each quarter-hour; *reports are requested* to the National Physical Laboratory, Teddington, Middlesex, England. (Patrick, Catch, Pearce, England; others)

Fiji Islands—ZJV, Suva, is noted daily around 0300 on *announced* 3.980; closes 0500; signal usually poor in Australia. (Williams) Lately noted back on 5.980A parallel 3.980. (Hardwick, N. Z.) Heard on this channel by Saylor, Va., 0100-0400 fade-out, with news 0215. Cain, Nevada, received ZVJ (m.w.) card verifying *tests* over 6.005 some time ago; had picture of native on card; *asked for more reports.*

France—Paris has *English* for Britain 0145-0200 on 7.240; 1500-1600 on 6.045A. (Catch, England) Mail Bag session on Wed.

French Morocco — Radio Maroc, 7.220, Rabat, noted at weak level opening 0700; good level when returned 0800, French news. (Pearce, England) This transmission closes 0900A; is listed with news in Spanish 0700.

Germany — Cologne, 11.795, noted with call and announcements in Spanish, German 1655 in transmission to Latin America; at 1703 news in German; good level. (*Mosquita e Sousa,* Portugal) Noted on this channel 2330 closing transmission to North America with *English* announcement; slight CWQRM, fair level. (Christie, Calif.) Although *not announced,* 5.98 parallels in this transmission 2030-2330A. (Bellington, N. Y.)

Greece — Central Forces Station, Athens, has returned to 7.420A and is heard 2325-0105; news in Greek 0027; CWQRM from 0005. (Arvidsson, Sweden) Is heard in Virginia sometimes around 2350-0200 fade-out. (Saylor) Larissa, 6.752, noted at good level around 1416 with music. (Lorentzson, Sweden)

Guadeloupe—FG8HA, 9.423AV, Basse-Terre, varies considerably; noted as

as 9.415, later back on 9.423AV; ked around 1939; heavy QRM. Niack, Ind.)

atemala—TGOQ, 9.705A, is heard 2315 without interference from , 9.700, Bulgaria. TG2, 6.618A, altenango, is good level as early 000 when identifies in Spanish as io Morse." TGNA, 9.668, 11.85, d *testing* in *English* with an- cements only 1130, 1215 recently, lent level. (Niblack, Ind.) Noted ng down on 9.668 in *English* 2345. vers, Ohio) TGWB, 6.182, good when closing 2400. (Cain, Neva-

iti—A strong signal is reported "Radio Commerce," *testing* at us times on 9.485A in French, ish, *English* and perhaps other uages; has been heard around -1230 sign-off; around 1700-2300 -off. By now is probably on reg- schedule of 0600A-2300. QRA is 94, Port-au-Prince, Haiti; *wants rts.* (West, Va., Grenell, Ohio; ngton, N. Y., others) Noted 1445 French. (Niblack, Ind.) With ch news 2100. (Balbi, Calif.)

least on Thur., 4VRW, *Radio i*, 10.065A, Port-au-Prince, has an *lish* program ("Your Music Cara- ") at 2130-2220; this one identifies *English* as well as French quite n now. (West, Va., others)

VEH, Cap Haitien, has received nission to go on the air in the 60- band with 1 kw., and in the 49-m. d with 5 kw., *daytime hours only;* uilding directional antennas. Lat- schedule is daily *except Thur.* 0600- , Sun. 1630-1900 on 9.690; Sun. 1900-2140, 9.728. Plans a Mailbag gram soon for *English*-speaking ners. (West, Va.)

Holland — Radio Nederland, 6.025, d 1545 with announcement in nish. (*Mesquita e Sousa,* Portu- Heard on this channel in *English* North America around 2200. (Crow- Pa.) Is good level in *English* 1645- on 11.73. (Mullen, Mass.) Noted 9.59 *after* 1800 in Dutch. (Zerosh,)

Honduras — Stark, Texas, notes *Rio Monserrat* down to 6.019 from 0 with continued distortion; opens und 0730 and signs off 2300A.

Hong-Kong — ZBW3, 9.525, noted , good level with music. (Sander- Australia) Lists *current* schedule Chinese-*English* as 2230-0000 Sun.- , 0400-0930 daily, 1900-2300 Sat., 0-2400 public holidays. (Scheiner, J.)

Hungary—Radio Budapest, 9.833, ed with *English* 1945-2000, then ngarian. (Grace, Conn.) Has *Eng-* for North America 1715-1745, 0-2000, 2300-2330, 11.91, 9.833, 7.22; dio Mailbag is Sun. (Smits, Minn.)

India—AIR, 15.380, noted signing on *glish* for Southeast Asia 0830; said allel on 11.78; had news 0835; off 5. (Pearce, England)

Indo-China (Vietnam) — According word direct from Saigon, there will *new* s.w. transmitters and increases power soon. (Scheiner, N. J.) In

verifying, *Radio France-Asie,* Saigon, listed *English* ... Europe 1100 on 11.950; 2030 on 11.935 to India; 0900 ... 11.935 to Southeast Asia, India; 1830 on 7.230 to Far Ea... and Southeast Asia; 0400 on 15.430 to Pacific. (A... vidsson, Sweden) *Radio Hirondelle,* 7.410A, Hanoi noto... around 0515; starts to fade 0600. (Williams, Australi... and others)

Ireland (Eire)—While vacationing in Ireland, Catc... England, visited *Radio Eireann* where he learned that ... *is not known* when s.w. broadcasts will be resumed, ... though both a *new* 100 kw. transmitter and a 1.5 kw. o... are available; the new 100 kw. transmitter is suitable f... the 16-, 19-, 25-, or 31-m. band but has never been test... although it is "warmed up" once a week.

Israel—Officials of the Israel Broadcasting Service i... form Scheiner, N. J., that *the new 50 kw. s.w. transmitt... should be on the air soon.*

Japan—Far East Network, AFRS, Tokyo, sent QS... card for 11.825, 9.605; listed JKL, 4.860, 0345-1000; 9.6... 1815-0330; 4.860, 1600-1800, JKI, 11.825, 1815-0330, 6.0... 1600-1800. (Pearce, England) *Radio Japan,* 15.135, not... 0005 with news, fair level in Iowa. (Lund) And in Was... ington State. (Simmons) Noted in Japanese 0030-01... (Glover, Texas)

Italy—Rome 9.750, noted with news 2145 to Nor... America. (Corson, Iowa)

Libya—Forces Broadcasting Station, 4.965, Tripo... noted 1531 with popular music; at 1600 closedown ga... time as "11 p.m.," and said would return 2330 on 1486 ... and "experimentally on 4.965." Said "Goodnight to liste... ers in Tripolitania and to short-wave listeners where... they may be;" closed with "God Save the Queen." F... merly used *announced* 4.782. Sent QSL card from No... Forces Broadcasting Station, Tripoli, M.E.L.F. 1; pow... listed 250 watts; transmitter is BC-610; antenna a dipo... Confirmed move from 4.782 to 4.965 and asked for furth... reports. (Pearce, England, others)

Mozambique—Current schedule received from Loure... Marques lists Portuguese 0000-0100, 0430-0630, 1045-1... on 11.815, 10 kw. 15.285, 10 kw., 4.829, 7.5 kw.; *Engl...* 2300-1300, 11.761, 7.5 kw.; 2300-1600, 4.916, 7.5 kw.; 01... 1000, 7.262, 7.5 kw.; 1100-1600, 3.490, 7.5 kw. (Scheiri... N. J.) The 4.916A channel noted at good level arou... 2330-0100 fade-out. (Saylor, Va.; Scheiner, N. J.) He... opening 0000 on 11.955. (Cushen, N. Z.) Heard well ... Sweden on that channel 1200 with news in Portugue... then music. (Lorentzson)

New Caledonia—Radio Noumea, F08AA, has been he... back on 6.035 with talk in French 0350; fair signal, ... clear. (Balbi, Calif.) Noted opening there 0200. (Willia... Australia) Heard by Fox, N. Z., and Sanderson, Austra... over a second transmitter on 3.350 at fair level.

New Zealand—ZL9, 11.81, Wellington, noted arou... 0000 with music. (Harder, Washington State)

Norway—Radio Norway, 9.610, Oslo, noted opening ... Western North America 2300 in Norwegian but also w... *English* announcements. (Deskins, Calif.) Closes 2... (Neyland, Calif.) Good on this channel to Eastern No... America 2000-2100. (Zerosh, Pa., others)

Pakistan—Radio Pakistan noted with news 1015-1... on 9.484; with slow-speed news 1310-1330 on 7.010, 11.... (Pearce, England) Heard widely to Turkey 1445-1530.... Britain 1530-1615 closedown on 11.65 parallel 9.645. (Bo... Conn.; Bellington, N. Y., others) Heard on 9.645 at 0... with Home Service of news, music. (Sanderson, Austra... Heard 2015-2100 over 11.885, some *English.* (West, ... And parallel on 15.335. (Cain, Nevada)

Paraguay—ZPA5, 11.95, has news in Spanish 1700; Q... from Lisbon. (Lorentzson, Sweden)

Peru—OAX4T, 9.562, Lima, *Radio Nacional del Pe...* noted 2305-2315 with Spanish music, announceme... (Morris, Pa.)

Philippines—Far East Broadcasting Co., Manila, ... heard well from 2300 onwards on its 17.805 outlet. (Hu... ins, Australia) DZ17, 6.080, Manila, noted in *English* ... relaying DZMB, (Williams, Australia) According to w... from DYSR-DYH-4, a *new* 10 kw. transmitter is plan... probably for use on 6.055; also plans to operate later... in the tropical band on a frequency of 3.277 mc.;

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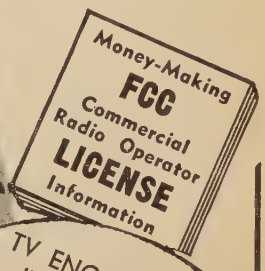

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fford E. Vogt. x 1016, Dania, Fla.	1st Phone	20
ancis X. Foerch Beucler Pl., Bergenfield, N. J.	1st Phone	38

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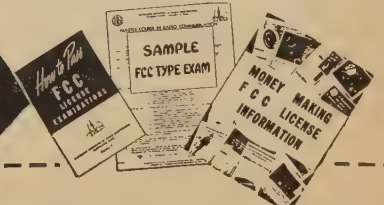

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City.....Zone.....State.....

Paste on 2-cent postcard or send air mail.

present uses 6.055 with 1 kw., 6 with a BC-610. (Williams) DZ 9.500, noted 0430 with *English;* DZ 9.640, heard with news, music and 0415. (Sanderson, Australia)

Poland—Warsaw, 7.145A, noted *English* for USA around 2320-2 (Morris, Pa.) Heard closing *Eng* to North America 1800 on 11.74; p ably opens 1745. (Roberts, Co Warsaw noted on 9.57 at 0930- with special program called "M the Common Language of All ples;" announces this for Wed., *only,* and says is parallel on 42.1 (Pearce, England)

Saudi Arabia—Djeddah was t recently *near* 7.095 at 1317 when interval signal, signed on 1323 march-anthem, call in native, usual man chanting without ac paniment; news in Arabic 1357A left air 1410. (Pearce, England) N on 11.95 at 2300 with Arabic prog of news, music. (Sanderson, Austr

Somali—Radio Somali lists freq cy as 7.420 but is heard near now; scheduled 0445-0530, 1200- in Italian; 0915-1015, 1100-120 Somali. (Pearce, England, others

Spain—Madrid's *English* sessi North America 2200-2245 on comes through well in Colo. (Ki

Sweden — Radio Sweden, Stockholm, is good level in *En* 2300A. (Lund, Iowa) weak signa 15.155 noted 1200-1215; some (Kirby, Mo.) Noted with *English* 0715 on 15.155. (Kubachi, Mass.

Syria — Radio Damascus, 11. noted with French news 1600 to rope. (*Mesquita e Sousa,* Portu Noted in *English* 1700-1730 closed news 1715. (Kroll, N. Y.) Ap parallel with 11.750A to Latin A ica closing around 2100. (Sch N. J., others)

Tahiti—Radio Tahiti, 6.134, Pap can be heard from around 2330 in to 0100 sign-off, using m French. Sign-on is listed 2245. (C Nevada) Papeete is heard on 6.9 good level to 0130 closedown; no *lish;* native to 0015, then Fr (Cushen, N. Z.)

Taiwan (Formosa)—BED4, 1 still noted with *English* to E 1320-1345; has French around "The Voice of Righteousness," Lin, Taipeh, says in part, "Our tion broadcasts in both Chinese *English* on 7.300, formerly 7.40 1700-2000;" *asked for reports on lish session.* (Pearce, England) B opens 0630 or 0700 daily on 7.355, level. (Williams, Australia) L Taipeh has been noted on *new* s ule to Western North America 0100, news 0030; fair on 15.235, on 11.735. (Balbi, Calif.) B 10.080, heard 0400 with Chinese and Western music; BED32, 9. heard 0415 with Western music, Chinese news; BED24, 9.820A, 0430 with Western music and C news, bad QRM. (Sanderson, tralia)

Thailand (Siam)—The Thai Signal Corps Radio Service, HSI

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2A6	89c	6AH6	1.89	6BH6	69c	6K5GT	.69	6SQ7	59c	7C5	.89	12AU7	.79	12SN7GT	.99	26	59c
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2B3	.89	6AK6	1.08	6BK7	1.19	6K7GT	.69	6SR7GT		7C7		12AV7	.89	12SQ7GT	69c	35A5	.99
2B7	.89	6AL5	69c	6BL7	.79	6K8GT	1.19	6SS7	.99	7E5		12AW6	1.19	12SR7GT		35B5	
2C34	.60	6AQ5		6BN6	1.19	6L5G	.95	6T7G	1.15	7E6	79c	12AX4	.69	12Z3	.95	35C5	69c
2E5	.89	6AQ6	.81	6BQ6G	1.19	6L6G	95c	6T8	.89	7E7		12AX7	.69	14A7	1.05	35L6	
2X2/879	.74	6AQ7	1.19	6BQ6GT	1.19	6L6GA		6U5		7F7	.89	12AY7	1.95	14AF7	.93	35W4	.59
3LP4	1.25	6AR5	.79	6BQ7	1.29	6L7	1.19	6U6GT	69c	7F8	1.47	12BA6	.59	14B6	89c	35Y4	99c
3Q4	.69	6AT6	.59	6BZ7		6N6G	1.40	6U7G		7G7	1.19	12BA7	1.19	14B8		35Z3	
3Q5GT	.89	6AS5	.90	6C4	.59	6N7GT	1.19	6U8	.89	7H7	1.05	12BE6	69c	14C5	1.25	35Z4	.75
3S4	.69	6AU5GT	1.29	6C5GT		6P5GT	.69	6V3	1.29	7I7	1.19	12BF6		14C7	1.12	35Z5	.55
3V4	.95	6AU6	.59	6C6	69c	6Q7GT	.59	6V6GT	.69	7K7		12BH7	.89	14F7	1.05	35/5	.79
5T4	1.40	6AV5GT	.89	6CB6		6R7GT	.69	6W4GT	.59	7L7	.79	12BY7	.89	14F8	1.45	36	1.06
5U4G	.59	6AV6	.59	6C8	1.29	6S4	.59	6W6	.69	7N7	.69	12BZ7	1.19	14H7	1.12	37	.93
5V4G	.87	6AX4	.69	6CD6	2.49	6S7GT	1.15	6X4	59c	7Q7	.79	12F5GT	.65	14Q7	1.05	38	88c
5W4	59c	6AX5	.79	6CD6G	1.69	6S8GT	1.25	6X5GT		7R7	1.19	12H6	.89	14W7	1.19	39/44	
5W4GT		6AX6	.69	6D6/78	1.10	6SA7GT	69c	6X8	1.29	7S7	1.19	12J5GT	.75	14X7	1.19	41	.72
5Y3GT	.45	6AY5GT	.89	6D8G	1.15	6SC7		6Y6G	.69	7V7	.79	12K7GT	.69	19BG6	1.89	42	.69
5Y4G	.54	6B4G	1.44	6E5	.69	6SD7GT	.99	6Z4/84	.72	7W7	1.19	12K8	.89	19BG6G		43	72c
5X4G	81c	6B8GT	1.15	6F5GT	59c	6SF5	.59	7A4	.95	7X6	1.05	12Q7GT	.89	19T8	.89	45	
5Z3		6BA6	.59	6F6GT		6SF5GT	.59	7A5	1.19	7X7	79c	12S8	.89	20	1.40	45Z5	.69
6A3	1.68	6BA7	.89	6F7	1.59	6SG7	69c	7A6	.89	7Y4		12SA7GT	.69	24A	.69	46	89c
6A7	89c	6BC5	.69	6F8G	1.59	6SH7		7A7	79c	7Z4	.89	12SC7	1.05	25AC5GT	1.04	47	
6A8GT	69c	6BC7	1.05	6G6G	.95	6SH7GT	.69	7A8		12A7	1.59	12SF5GT	.69	25BQ6	1.19	50A5	1.05
6AB4		6BD5GT	.89	6H6GT	.89	6SJ7	.79	7B5	.89	12A8	.69	12SF7	.99	25BQ6GT		50B5	69c
6AB7	1.15	6BE6	.59	6J5GT	.59	6SJ7GT	59c	7B6	.89	12AH7	1.38	12SG7	.89	25L6GT	.59	50C5	
6AC5GT	.89	6BF5	69c	6J6	.79	6SK7GT		7B7	89c	12AL5	.54	12SH7GT		25W4GT	.69	50C6G	1.39
6AC7	1.45	6BF6		6J7G	.69	6SL7GT	.69	7B8		12AT6	.59	12SJ7GT	69	25Z5	.69	50L6	.69
6AG5	1.05	6BG6	1.89	6J8G	1.15	6SN7GT	.69	7C4	1.30	12AT7	.89	12SK7GT		25Z6GT	.69	50X6	.69
6AG7	1.49	6BG6G								12AU6	.69	12SL7GT		32L7GT	1.15	50Y6	.99

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58		70L7GT	
71A	.87	75	.79
77	.69	78/6D6	1.10
80	.69	83	1.45
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VR90	$1.19	VR105	
VR150		VT51	29c
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117Z3	.59	117Z6	1.19
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Double bay array, with stacking bars $7.75

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6 Element Conical. Only..... $2.95

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Bowtie Reflector
Ultra-high Gain

Completely assembled—ready to mount. For all UHF Channels—easy to stack for two or four-bay

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D-550		
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40 mfd. @ 150V 20-20		.39 ea.
80 mfd. @ 150V		
8 mfd. @ 450V		.27 ea.
8-8 mfd. @ 450V		
10-10 @ 450V		.29 ea.
10-10 mfd. @ 450V		
100-25V		.39 ea.
20 mfd. @ 440V		
40-400V		.44 ea.
30 mfd. @ 150V		
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Value $8.00. Tube Kit only..... $1.98

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Very best quality—NATIONAL BRANDS. Individually Packed.

3".....ea.	$1.39	8".....ea.	$3.23
4".....ea.	1.59	10".....ea.	5.10
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PILOT LIGHTS, Type No. 47 ..... 10 for 39c; 100 for $2.95
VOLUME CONTROLS with SWITCH, 2" shaft. ... meg, ½ meg, 1/4 meg..34c
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100 Condensers assorted in package..... **$6.95**

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.002	6c	.02	8c
.005	6c	.05	10c
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400-VOLT	
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.2 mfd	ea. 7c
.25 mfd	ea. 12c
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Twin Lead Type—300 Ohm

20 Gauge—7 Strand No. 28 AWG Copperweld Wire for Maximum Strength and Maximum Flexibility. Constant impedance under all conditions. The "Z" Line is an attractive, easy to handle UHF TV lead for maximum signal.

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75 mil.	79c
100 mil.	89c
150 mil.	$1.32
200 mil.	1.85
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For VHF Channels 2 through 13. Clears VHF picture, stops interference at once, 30 seconds to attach.

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All-Angle Base Mount, UL Approved Twin Lead Lightning Arrester, 50 ft. 300 ohm Twin Lead, 6 Insulated Screw Eye Stand-Offs, 2 Insulated Mast Stand-Offs, 5 ft. Weather-Proof Mast 1¼" OD.....$3.95

Lifetime Chimney Mount

30 ft. of Stainless Steel Strap with HEAVY ZINC BRACKETS for dealers who sell quality Chimney Mount for TV and ant.....

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heard daily 0630-0700 on 4.875; poor signal in Austral The Overseas Service on 11.700 is strong from 0600, though has some QRM from *Radio Japan,* 11.705. (W liams) Has news 0515-0530; service runs 0500-0700. T lower-powered transmitters now open 0630 and carry T Home Service. Call on 11.700 appears to be HSK9. (Ra Australia, others) Is heard on 6.000A parallel the 11. outlet. (Williams)

Trieste—The *British Forces Station,* 15.125, signs 1800 with "God Save the Queen." (Ferguson, N. others) Station officials say "The Service is intended comparatively local reception and you may find t future listening conditions will deteriorate as we ma final adjustment to our aerial system." (Patrick, Engla Should sign on at 1100.

Turkey—The Technical School of Istanbul station been off the air this summer, but should return by middle of October—presumably on old channel 6.69 (WRH) The Technical University of Istanbul is heard 7.030 from about 1315 to 1500 (*except Sat.*); is to incre power shortly to 1 kw.; has CWQRM. (Patrick, Engl and others)

USI (*Indonesia*)—Djakarta, 9.710, noted with mu 1000 and announcement in very poor *English,* (Har Washington State) Plans to install *two* more 50 kw. tra mitters; these are expected in Indonesia at the end this year and might be in use soon after that "to enla and to improve our foreign broadcasts," officials have formed Scheiner, N. J. according to the *N. Z. DX Tim* YDD, 3.205, Djakarta, is good level in N. Z. 0730 v news in Indonesian, and Jogjakarta, 5.060, is strong l there at 0800.

USSR—Alma Ata, 9.340, has been heard in Swe 0900. (Skoog) Grenell, Ohio, says Radio Moscow is c ing through nicely all day (*EST*) on 11.78, 9.59.

Vatican—HVJ, 11.74, is sometimes readable 1315-1 in English period. (Niblack, Ind.; Scheiner, N. J.)

Venezuela—YVOA, 4.830, signs on 0530; YVNB, 4.82 heard 0630 atop Singapore, Malaya. (*N. Z. DX Times*

Yugoslavia—*Radio Yugoslavia* has *English* 0115-013 9.618, 6.100; at 1645-1700 on 6.100. (Pearce, England) native musical session 2200-2230 daily on 6.100, 9. (Bellington, N. Y.)

Press Time Flashes

Arthur T. Cushen, Invercargill, N. Z., for many y a regular contributor to the *ISW DEPARTMENT,* recently awarded the Coronation Medal by Her Maj Queen Elizabeth II, for the POW work he has done the years. Arthur has received his 1000th BCB veri tion, and his s.w. veries now total around 1600.

"Deutsche Welle", Cologne, "The Voice of Germa has informed Scheiner, N. J., that reception reports be verified with a QSL card if, aside from technical d details about 15 minutes of programming are include order to allow for a clear comparison with our prog lists". QRA is Deutsche Welle, Koln, NWDR, Wallraf 5, Cologne, Germany.

Canada's service for the Northwest Territories is li daily 2340-0020 over 9.585, 6.060; Mon.-Fri. *only,* 0725- over 11.90,9.63.

Radio Cotonou, Dahomey, operates in French, Daho dialects 0145-0200, 1225-1330 (to 1400 Sat.) over 1485 1 kw., and on 41 m. with 250 watts (to be increased kw. in 1954). (Scheiner, N. J.) *What is 41-m. freque*

A Colombian station on 6.196A has been heard ar 2228 when identified as "La Voz de Cali." (Belling N. Y.; Niblack, Ind., others) *Radio Sweden* lists cal HJEZ, but Stark, Texas says is "La Voz del Valle," moved up from 6.135, with call of HJEV.

Berne, Switzerland, recently *tested* (with relay o European program) on HER22, 3.961; HER33, 3 HER44, 3.989; heard well in Britain around 1700. (Pe Catch, Patrick)

Listeners in the South Pacific have been alerted t port reception as soon as the *new* station on Pit Island takes to the air; watch for a report on this over Radio Australia's DX session Saturday 2300, 15 repeated Sunday 0830, 9.615.

English broadcasts from *Radio Sweden* are 1930-202 2100-2145, 2200-2215, 9.535; 2300-2315, 15.155; 2300-232 11.880; 0000-0030, 15.155; 0600-0615, 0700-0715, 0800-08(0930-1030, 1200-1215, 1300-1315, 15.155; 1500-1530, 6.0(1800-1815, 11.880. (*ISWC*, London)

Current Paris schedules include French 2230-2245, 7.1 0030-0130, 9.550; 0145-0230, 11.920, 15.240; 0230-0300, 15.2 17.850; 0530-0600, 15.240; 0758-1000, 15.400, 17.850; 11 1215, 15.350, 17.850; 1215-1300, 9.675, 11.845; 1500-15 5.995, 7.105, 9.685; 1500-1630, 11.700, 15.240; 1730-1800, 9.6 1830-2000, 9.685, 11.700. *English* 0145-0200, 7.240; 15 1600, 6.045. German 1300-1400, 6.045. Spanish 1600-16 5.955, 7.240; 1800-1815, 9.685, 11.700. Portuguese 0200-02 1300-1315, 7.240; 1400-1430, 7.240, 9.765. Home service lays are Program National on Sun. 0400-0500, 7.200; P gram Paris-Inter, weekdays 0100-1100, 6.200, 1100-18 6.200, 9.550; Sundays 0130-0400, 0500-1115, 6.200, 1115-18 6.200, 9.550. (*WRH*)

A French-speaking station heard on 6.11A at 0 through heavy QRM may be *Radio France-Asie*, Saig Indo-China (Vietnam), no longer found on 9.75A at t time. (Balbi, Calif.) *Radio Renascenca*, Portugal, opera on 6.154 at 1230-1800. (Radio Sweden)

Latest schedule of "Deutsche Welle." Cologne, C many, is 2030-2330, 5.980, 7.290 (to North Americ 0530-0830, 15.275; 0930-1230, and 1700-2000, 11.795.

Acknowledgement

Thanks for FB reports; keep them coming during winter DX season to Ken Boord, 948 Stewartstown Rd Morgantown, West Virginia, USA. Good listening, lows! ..... K.

DISTRIBUTOR SEMINARS PLANNED

THE JOINT Electronic Parts Show—NEDA committee appropriated $30,000 to conduct a series of regional se nars and educational programs for distributors, replacing educational sessions formerly held during the Parts Show

Tentative plans include seminars to be held in centr located cities in six trade areas.

Buy on our radically new

NO INTEREST!!

Time Payment Plan

NO CARRYING CHARGES!!

Measures 6¼" x 9½" x 4½"

Superior's new Model 670-A SUPER METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Quality test for electrolytics)
REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to +18 +14 to +38 +34 to +58

ADDED FEATURE:

The Model 670-A includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions.

$28.40 NET

Superior's new Model TV-11 TUBE TESTER

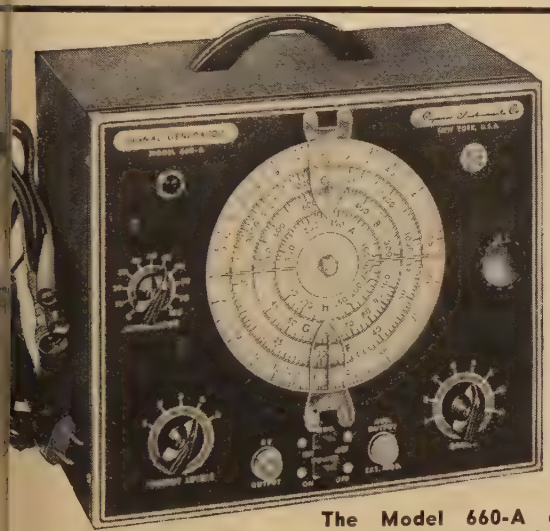
SPECIFICATIONS:

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron, Miniatures, Sub-Miniatures, Novals, Sub-minars, Proximity fuse types, etc.
★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.
★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
★ Free-moving built-in roll chart provides complete data for all tubes.
★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.
★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

The model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover

$47.50 NET



The Model 660-A comes complete with coaxial cable test lead and instructions.

Superior's New Model 660-A AN AC OPERATED SIGNAL GENERATOR

PROVIDES COMPLETE COVERAGE for AM-FM & TV Alignment

SPECIFICATIONS:

• Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 220 Megacycles on powerful harmonics. • Accuracy and Stability are assured by the use of permeability trimmed Hi-Q coils. • R.F. available separately or modulated by the internal audio oscillator. — Built in 400 cycle sine wave audio oscillator used to modulate the R.F. signal also available separately for audio testing of receivers, amplifiers, hard of hearing aids, etc. • R.F. Oscillator Circuit: A high transconductance heptode is used as an R.F. oscillator, mixer and amplifier. Modulation is effected by electron coupling in the mixer section thus isolating the oscillator from load changes and affording high stability. • A.F. Oscillator Circuit: A high transconductance heptode connected as a high-mu triode is used as an audio oscillator in a High-C Colpitts Circuit. The output (over 1 Volt) is nearly pure sine wave. • Attenuator: A 5 step ladder type of attenuator is used.

Tubes used: 1—6BE6 as R.F. Oscillator, mixer and amplifier. 1—6BE6 as Audio Oscillator. 1—6H6 as Power Rectifier.

$42.95 NET

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. B-77, 38 Murray St., New York 7, N. Y.

Please send me the units checked. I am enclosing the down payment with order and agree to pay the monthly balance as shown. It is understood there will be no carrying, interest or any other charges provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Name.....

Address.....

City.....Zone.....State.....

- ☐ MODEL 670-A.....Total Price $28.40 $7.40 down payment. Balance $3.50 monthly for 6 months.
- ☐ MODEL TV-11.....Total Price $47.50 $11.50 down payment. Balance $6.00 monthly for 6 months.
- ☐ MODEL 660-A.....Total Price $42.95 $12.95 down payment. Balance $5.00 monthly for 6 months.
- ☐ I enclose $.....as down payment.
- ☐ Ship C.O.D. for the down payment.

WHAT'S

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page and the issue number, delay will be avoided.

TAPE RECORDER

Crescent Industries, Inc., 5900 W. Touhy Avenue, C cago 31, Illinois is marketing a low-cost tape record the Model 907.

The new recorder is a dual-track, 7½ inch-per-secc machine with fast forward and rewind, essentially f frequency response from 70 to 8500 cps, less than ½ o per-cent wow and flutter, a 3-watt amplifier, and only c control for record and play. It will handle up to 7 in reels, gives two hours of recording time, has mike a radio-phono input, plus 3.2 ohm output for speaker a high impedance output for connection to an external a plifier.

A companion model, the 903, is available for those v want the 3.75 inch-per-second speed.

A data sheet on this new recorder is available from company on request.

BATTERY ELIMINATOR-CHARGER

Electronic Instrument Co., Inc., 84 Withers Stre Brooklyn 11, New York has responded to the demand a combined 6 volt and 12 volt battery eliminator charger by bringing out the *Eico* Model 1050 in kit wired form.

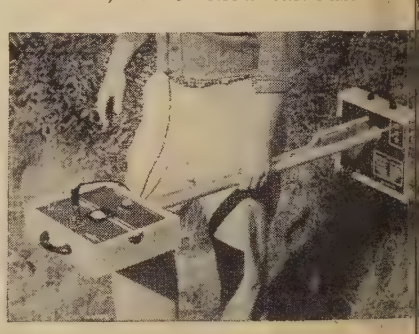
The unit is designed for use as a battery eliminator the servicing and demonstrating of both 6- and 12-v operated auto radios, marine and aircraft equipment, for charging both 6-volt and the new 12-volt stor batteries.

Rated above normal needs in these applications fully protected against overloads, the Model 1050 inc porates continuously variable output voltage, separ voltmeter and ammeter, and quality components throu out. In kit form, the instrument is designated as Model 1050-K.

METAL DETECTOR

The Radiac Company, Inc., 489 Fifth Avenue, New Y 17, New York is currently offering the "Private Eye," portable ten-pound electronic detector for locating me and minerals in all terrains, flat or mountainous.

A unique, simplified, high-efficiency circuit provides high sensitivity and penetration. The unit was designed for use by public utility companies and engineers as well as for treasure hunters, prospectors, etc.



The "Private Eye" is enclosed in a baked enamel, minum case of modern design. It uses low voltage r batteries and consists of transmitter and receiver may be folded in suitcase fashion when not in use.

GERMANIUM DIODES

Hermetically-sealed germanium diodes in produc quantities are now available from *Hughes Aircraft C pany's* Semiconductor Department, Florence Ave. at T St., Culver City, California.

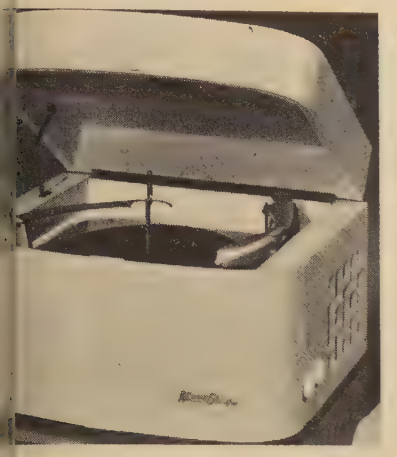
The units are supplied in seventeen RETMA (RT types, including three JAN-approved diodes, as well other types laboratory-tested to customers' special quirements.

glass-to-metal seal is made by a special *Hughes*-ped process of fusion sealing at high temperatures. sult is a rigid, one-piece glass envelope which in-complete freedom from moisture penetration of the envelope.

iries on these diodes should be sent to the firm's nductor Sales Department.

WILCOX-GAY PHONOGRAPH

ox-Gay Corporation, 79 Washington St., Brooklyn 1, has entered the home high-quality phonograph instrument field with a new table model automatic player for all type records.



The especially-designed, three-speed changer utilizes a turn-over ceramic cartridge with sapphire needles which is used in conjunction with a custom-built amplifier with push-pull amplification. The set uses two side-mounted 6-inch ers featuring extra-heavy *Alnico* magnets. The cabi-tyled with a rounded front, has a built-in acoustic per which is constructed to match the electrical re-ments of the speaker system and amplifier.

four-tube amplifier delivers 3 watts of audio out-Frequency response of the unit is 40 to 12,000 cycles.

VOLTAGE REGULATOR

on Instrument Corp., Division of *American Car and dry Company,* 291-26 State Highway #17, Paramus, Jersey has developed a new a.c. regulator for 400-supplies.

rms output voltage is adjustable with regulation to r-cent up to half the rated load (50 volt-amperes) o .02 per-cent up to the full rated load (100 volt-res). This regulation is maintained with allowable voltage fluctuations of ± 10 per-cent, about the ted output level and frequency fluctuation of ± 5 ent. Recovery time from transients is less than .01 d. Developed harmonics are less than 1 per-cent.

regulator measures 17" x 9½" x 7" and is easily ble or suitable for bench mounting. Further infor-n will be supplied by the manufacturer on request.

PRECISION RESISTORS

e Resistor Corp. of Erie, Pa. is now in production on tt deposited carbon precision resistors in values from hms to ½ megohm. Standard tolerances are 1, 2, per-cent.

distinctive feature of this stable pyrolytic resistor, nated as Style 155, is the one-piece molded case. The nosetting molded insulation provides protection st humidity and also gives assurance against me-cal damage to the carbon film. Added insulating ing is not required on these units.

VIBRATOR TESTER

R. Mallory & Co. Inc. of 3029 E. Washington St., In-polis 6, Ind. has added a vibrator tester to its line rvice equipment.

e 12VT1D is designed as a companion unit to other topower" bench power supplies and will test directly, out adapters, either 6 or 12 volt vibrators of the most lar types and all auto radio vibrators used since 1940. conjunction with a filtered d.c. power supply, such as *Mallory* 12RS6D or 12RS14D, the vibrator test-

er will test accurately either self-t tifying or tube-rectified vibrators any frequency from 100 to 250 cyc

Over-all dimensions are 6¾" h 10⅜" wide, and 5½" deep. Shipp weight is approximately eight pou

TRANSISTOR TESTER

Dunn Engineering Associates, Windsor Street, Cambridge, Mass. introduced a new piece of test eq ment, the DEA Model 2 transi characteristic plotter.

The new unit automatically disp any one of four different familie static characteristic curves on face of an auxiliary oscilloscope. sets of curves presented are the tr fer characteristic and the colle characteristic for both grounded-e ter and grounded-base connect The rapid repetition rate of the plays obviates flicker and therma

fects. Both *n-p-n* and *p-n-p* junc transistors as well as point-con units can be accommodated.

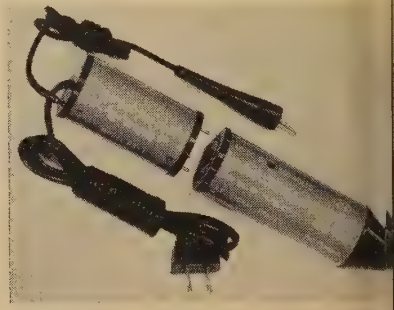
The unit is intended for both duction line and laboratory use descriptive bulletin is available the manufacturer.

POWER SUPPLY

Lee Electronic Labs, Inc., 233 ley St., Boston 19, Mass. has devel a new miniature electronic power ply, Model PS-1, for use with Model E-C or E-A circuit analyze

The new unit provides both a.c. d.c. test voltages, permitting ar tremely wide range of resistance continuity tests and increasing sensitivity of the analyzers to 200 megohms.

The Model PS-1 features a m



ture selenium rectifier and dual denser *RC* filter network in a sp circuit. The plug-in design, to n the analyzer models, comes wi 6 foot power cord and rubber plu operates on any 100-125 volt a.c.

18-INCH WOOFER

C.-S. Manufacturing Company, Lincoln Blvd., Venice, Californ

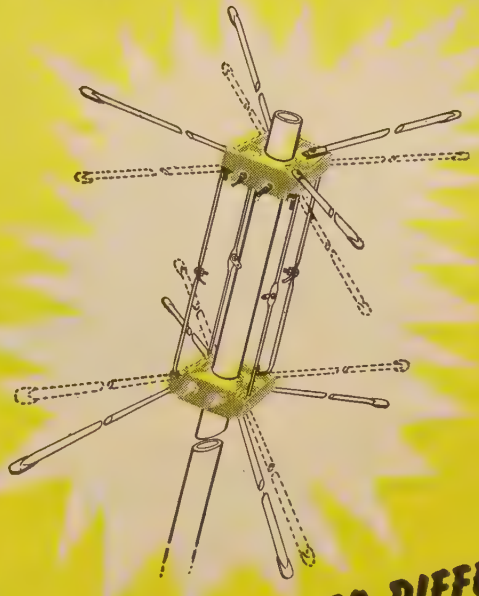
MONEY BACK GUARANTEED

TO RECEIVE *All* UHF and *All* VHF STATIONS IN *All* DIRECTIONS FOR 60 MILES

WITHOUT A ROTORMOTOR OF ANY KIND!!

WORLD'S MOST POWERFUL UHF—VHF TELEVISION ANTENNA

While antenna reception is guaranteed for 60 miles, perfect pictures have been consistently received as far as 160 miles from stations.



MODEL SUPER 60

All NEW DESIGN FOR '54

- LOW-LOSS SWITCH
- LOW-LOSS PHENOLIC INSULATORS
- USES NEW 4-CONDUCTOR MATCHED IMPEDANCE LINE
- ONLY 10 INCH SPACING BETWEEN ANTENNA BAYS

ONE INSTALLATION ONE ANTENNA
ONE TRANSMISSION LINE

SO NEW! SO DIFFERENT! IT'S PATENTED!

#2,585,670
#2,609,503
#2,625,655
#2,644,091

Money Back Guarantee

IN ALL LOCATIONS IN EVERY AREA WITH STATIONS IN ALL DIRECTIONS

The new All Channel Model Super 60 is guaranteed to bring in, immediately on installation, every UHF and every VHF station within 60 miles in any direction, giving clearer and sharper pictures than any antenna or combination of antennas with or without rotor motors.

If, immediately on installation, it fails to do this, we agree to refund to the jobber to whom we sold and shipped it, his full purchase price.

The 9 position selector switch electronically rotates the antenna in a stationary position.

LIST PRICE **$36.75** SEE YOUR LOCAL JOBBER

PRICE INCLUDES
Complete stacked array • 4 stacking bars • 9 position switch • Switch-to-set coupler • 3 - 7½" stand offs • Individually boxed in mailable carton

BE READY NOW — FOR THE FUTURE

ALL CHANNEL ANTENNA CORP., 70-07 QUEENS BLVD. WOODSIDE 77, NEW YORK

now marketing an improved 18-inch woofer, the Model #CS-518.

Frequency response is from 30 to 4000 cps; maximum power input is 25 watts; impedance is 12 ohms. The cone resonance is 27 to 31 cps. The over-all diameter of the speaker is 18 inches, the baffle opening is 16¼ inches, and the depth behind the panel is 7½ inches.

Information for bass-reflex, horn-loading, and air-coupler enclosures may be obtained from the manufacturer on request.

TRADEMARK DECALS

Tekni-Labels Company, 232 North Glenoaks Blvd., Burbank, California has added an "Alphabets" and "Trademarks" series to its line of decals.

The new series are available in four colors: white, black, red, and gold. With these new sets it is possible for individual technicians to make their own trademarks, name plates, decorative panel designs, etc. By combining portions of different colored decal sets, multi-color designs and trademarks can be made.

R.F. BRIDGE

Boonton Radio Corporation, Boonton, N. J. has recently introduced a new completely self-contained r.f. bridge, the Type 250-A RX meter.

The new instrument permits the direct measurement of equivalent parallel resistance and capacitance of two-terminal networks over an unusually wide frequency range. It has a frequency coverage of 500 kc. to 250 mc. in eight ranges; a resistance range of 15 to 100,000 ohms; and a capacitance range of + 20 $\mu\mu$fd. to — 100 $\mu\mu$fd. Resistances from 0 to 15 ohms may be determined by indirect means while the capacitance range can be increased to 0 to 120 $\mu\mu$fd. by use of auxiliary resonating coils.

The company will provide complete details on request.

"MICRO-POLISHING" PROCESS

Reeves Soundcraft Corporation, 10 E. 52nd Street, New York 22, N. Y. has developed and patented the new "Micro-Polishing" process which is now being used in the manufacture of the company's complete line of magnetic recording tapes.

The new process develops high mechanical stresses on the oxide nodules and the surface of the tape, resulting in a mirror-smooth finish, thus practically eliminating drop-outs and increasing the accuracy of magnetic calculating systems.

All of the company's magnetic re-

ng tapes are now being subjected
process at no increase in the
g price.

ATR INVERTERS

rican Television & Radio Com-
300 East Fourth St., St. Paul,
sota has introduced a series of
odels in its line of inverters.
new units operate from 6- or

st car storage batteries and pro-
110 volt a.c. 60-cycle output in
s wattage capacities for the op-
n of dictating machines, tape re-
rs, wire recorders, radio sets, test
ment, and other related small
ical or electronic apparatus.
erter models are also available
perating from other d.c. input
ges ranging from 6 volts d.c. to
olts d.c.
nplete literature is available
the factory.

RADIOPHONE

mmunication Research & Devel-
nt Co., Inc., 9530 Aurora Ave.,
le 3, Washington is now in pro-
on on a new, self-contained radio-
e which weighs only 14 pounds.
own as the Model B-3, the set
es portable radio batteries and
be supplied for any frequency
2 to 30 mc. with crystal control
th sending and receiving. The re-
r uses two 1L4's, a 1R5, a 1U5,

output push-pull 3S4's. The trans-
er section uses six 3S4's.
e company will supply full details
e Model B-3 on request.

METER CALIBRATOR

lbfell Laboratories, Inc., P. O.
1578, San Diego 10, California has
d a meter calibrator to its *"Kay-*
line of electronic instruments.
e Model 123 is a precision d.c. ref-
ce source which produces a cali-

brated voltage essentially independ of input line voltage and output l variations.

Accurate and simple calibration d.c. meters is afforded by this ins ment. The circuit continually c pares the output voltage against internal standard cell and in manner insures absolute calibra and stability.

The company will supply additi information on request.

TOOL CASE

Of interest to radio and televi technicians is the newly-develo tool case now being offered by *Gen Cement Mfg. Co.,* 919 Taylor Rockford, Ill.

Designed to be worn on the belt, new case is fitted to hold an unusu large number of hand tools. The is molded of "Alathon," a tough flexible material which will withs the most rigorous service conditi

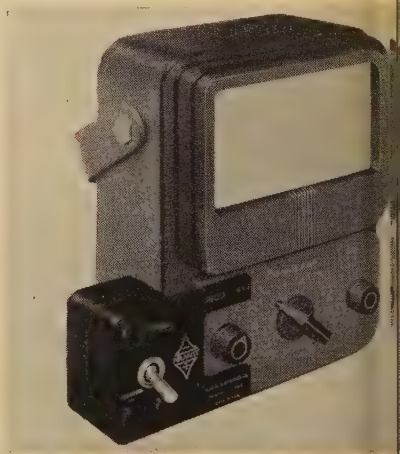
ELECTRONIC RELAY

Servo-Tek Products Co., 1086 C Road, Hawthorn, N. J. is in pro tion on an "ultra-sensitive" electr relay which is available for imme delivery.

The relay action is initiated by ternal contact as high as one megohm with current as low 1/10,000 ampere. The unit mount a standard 4-inch electrical conne box and will operate on 115 volts 60 cycles, single phase. Other volt and frequencies are available on cial order.

POLARITY REVERSING SWITCH

Pomona Electronics Co., 524 W Avenue, Pomona, California is



offering a meter reversing pol switch, the Model MS-1.

The switch is designed to re polarity when making circuit without removing the test lead t meter and can be instantly atta by plugging into test lead hol the *Simpson* tester model 26 which the switch was exclusive signed.

Of compact, durable phenolic struction and scientifically engin for the technician's use, the swit now available at local jobbers.

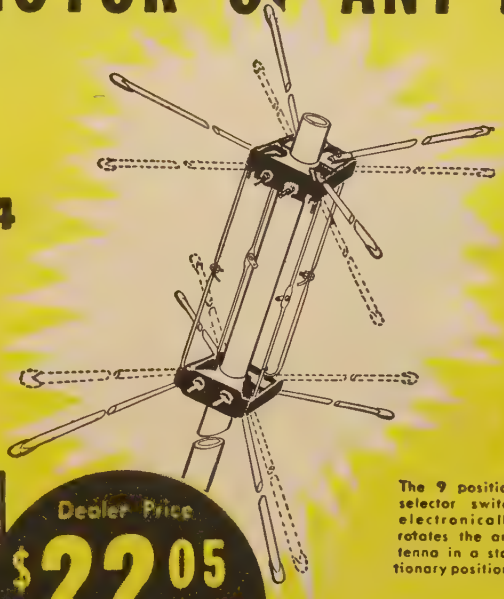
Concord Radio presents the world's most powerful UHF-VHF-FM antenna!

MONEY BACK GUARANTEED

TO RECEIVE *All* UHF and *All* VHF STATIONS IN *All* DIRECTIONS FOR 60 MILES

WITHOUT A ROTORMOTOR OF ANY KIND!!

While antenna reception is guaranteed to 60 miles, perfect pictures have been consistently received as far as 160 miles from stations.



MODEL

SUPER 60

The 9 position selector switch electronically rotates the antenna in a stationary position.

All NEW DESIGN FOR '54

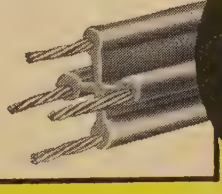
- LOW-LOSS SWITCH
- LOW-LOSS PHENOLIC INSULATORS
- USES NEW 4-CONDUCTOR MATCHED IMPEDANCE LINE
- ONLY 10 INCH SPACING BETWEEN ANTENNA BAYS

NEW! POLYMICALENE 4 CONDUCTOR
Matched Impedance
TRANSMISSION LINE

Improves Both UHF and VHF Performance of any ALL-CHANNEL Antenna!

100 Ft.	$8.90
150 Ft.	$13.90
200 Ft.	$17.50

Minimum quantity 100 ft.



Dealer Price
$22.05
LIST PRICE
$36.75

PRICE INCLUDES
Complete stacked array • 4 stacking bars • 9 position switch • Switch-to-set coupler • 3 - 7½" stand offs • Individually boxed in mailable carton

Mfg. solely by
ALL CHANNEL ANTENNA CORP.
New York N. Y.
under license Pat. No's 2,585,670. 2,609,503. 2,625,655. others pending.

WRITE FOR FREE CATALOG
Concord Radio
53 Vesey Street, New York 7, N. Y. • Digby 9-1132

CONCORD RADIO 53 Vesey Street, New York 7, N. Y.

Please send me.....amount at $36.95 list price.
Please send me.....amount at $22.05 dealer net.
Dealers order on letterhead.
Please send me.....feet of 4 conductor tubular at
Name_____
Address_____
City_____State_____
☐ Check Enclosed ☐ Money Order Enclosed
☐ C.O.D. enclosed please find 25% of total purchase price . . . check . . . Money Order. Send Giant New FREE Concord Catalog at once ☐
☐ Please put my name on your "Special Bargain" mailing list.
( ) Enclosed find $_____in full. Send prepaid.

1954 G-E TV Sets

(*Continued from page 66*)

noise pulse is bypassed to ground. Each noise pulse, therefore, short-circuits the sync amplifier output and the noise pulses are thus prevented from reaching the clipper grid.

Oscillographic examination of the sync amplifier output on noise-ridden signals will show actual "holes" in the composite sync and video signal. These "holes," which extend to the baseline, are the inverted noise pulses that have committed suicide.

The inherent flywheel effect of the horizontal and vertical oscillator circuits tends to maintain synchronism during periods when sync pulse output is lost at the clipper because of noise inverter action.

R_{304} and C_{322} in the grid circuit of the inverter form a filter that prevents signal voltages from appearing on this grid. This filter does not, however, impede the relatively slow changes in bias obtained from the second detector.

Switch S_{301} is a "local-fringe" switch located on the rear apron of the chas-

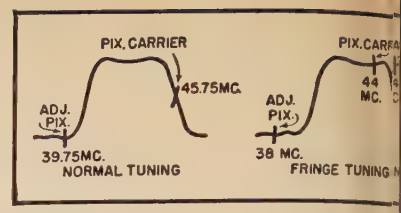


Fig. 7. Response curves for both norm and fringe areas to provide best tuni

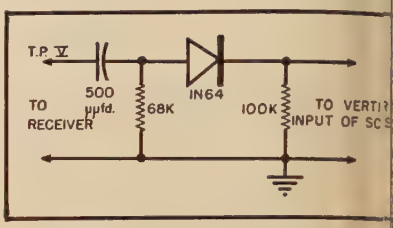


Fig. 8. Detector circuit for step 4. Tak

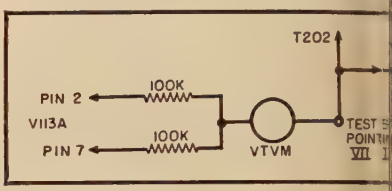
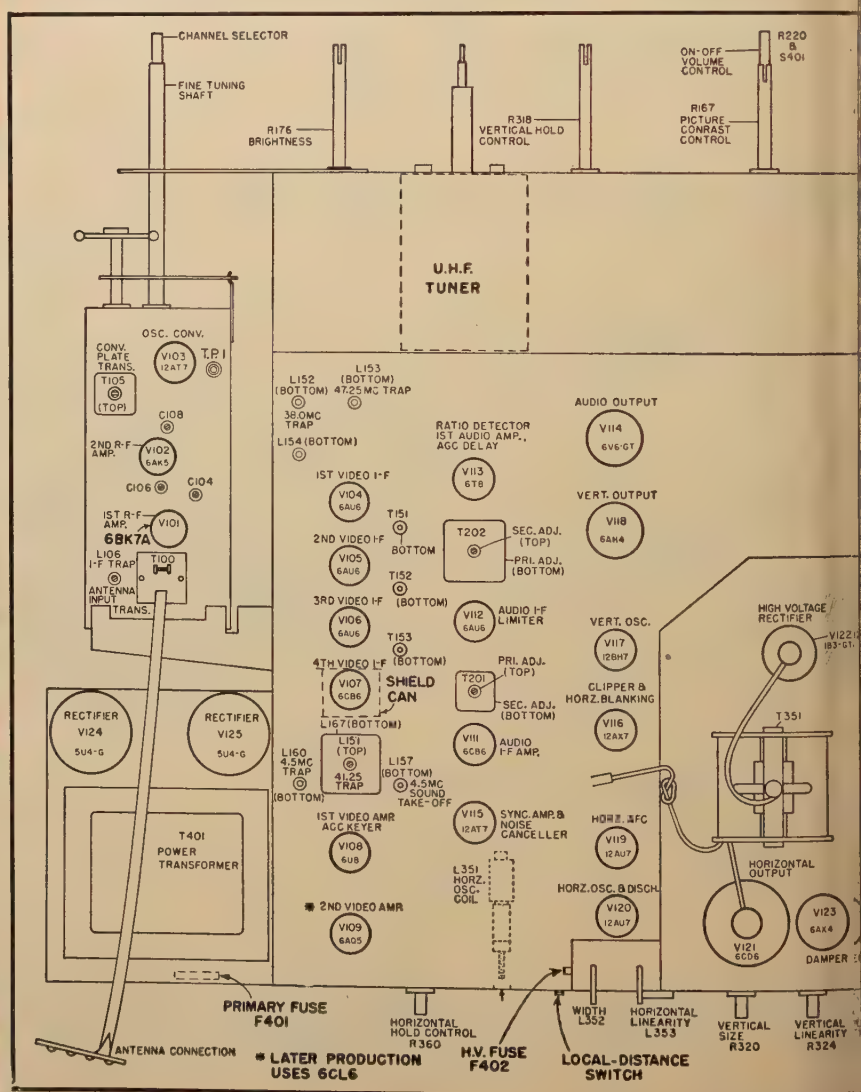


Fig. 9. Resistor network used in step Table 1. The resistors are equal within

Fig. 10. Top view of the G-E "EE" chassis showing the tube and parts layout.



he "local" position, the output
ync amplifier is reduced by de-
g the plate load; simultaneous-
cathode bias on the noise in-
s increased so that this tube
conduct on the tips of sync
on strong signals.

inverter test: To test the
verter, connect an oscilloscope
output of the sync amplifier
ain a relative, composite sync
evel. On sets so equipped, set
ocal-fringe" switch to the
' position. Next, open the cath-
cuit of the noise inverter or
R_{340} with a 22,000 ohm resistor.
of these operations should re-
a slight increase in sync pulse
n the oscilloscope. In normal
on in strong signal areas, the
nverter tends to "wipe-off" a
mount of sync pulse. Thus, dis-
the inverter should increase
evel slightly. In noisy, fringe
the noise-inverting action of
cuit can be clearly observed by
the "holes" in the video and
gnal at the sync amplifier out-

C. circuit: The pentode section
6U8 (V_{108B}) is employed as a
tube whose plate supply con-
positive pulses taken from a
the high-voltage transformer.
keyed a.g.c. has been covered in
previous articles, a detailed ex-
on of this circuit should not be
ary.

ointed out earlier, it is highly
le to operate the 6AK5 second
ge without a.g.c. in fringe areas
tain the best signal-to-noise
This is accomplished by bucking
w a.g.c. voltage levels through
age divider network connected
3+" source. Diode V_{113C} (¼ of a
cts as a clamp to prevent posi-
oltage from appearing on the
grid. With strong signal recep-
he a.g.c. voltage rises above the
g voltage and the diode can be
ered out of the circuit.

ical and horizontal blanking:
al retrace blanking is accom-
d by feeding a highly positive
" to the cathode of the picture
during the retrace period. This
is picked off the plate of the
al output tube, sharpened up
ferentiated) by R_{328} and C_{317} and
d to the picture tube cathode
h R_{330} and C_{174}. V_{116B}, the hori-
l blanking triode, performs no
on in the vertical blanking op-
n.

izontal blanking is accomplished
ain feeding a positive pulse to
thode of the picture tube during
orizontal retrace period, thus
g the tube to cut-off. V_{116B}, the
ntal blanking tube, is connected
athode follower. Positive pulses,
l off the high-voltage transform-
ough C_{368} are applied to the grid
blanking triode. These pulses
r in the same polarity but at a
impedance at the cathode of the
er and are then fed to the pic-
ube cathode.

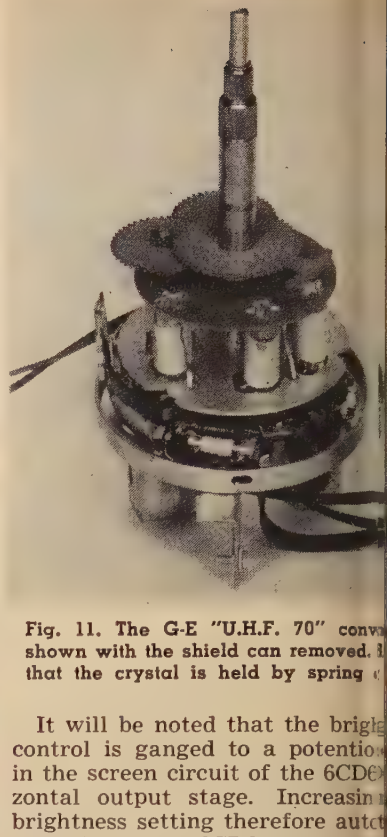


Fig. 11. The G-E "U.H.F. 70" conv shown with the shield can removed. that the crystal is held by spring

It will be noted that the brigh control is ganged to a potentio in the screen circuit of the 6CD6 zontal output stage. Increasin brightness setting therefore autc cally increases 6CD6 screen vo This arrangement tends to coun picture "blooming" caused by in ing current drain from the high age supply.

The primary line fuse, F_{401}, is s ed behind a protective cover o rear apron of the power-supply sis. A low-voltage tap on the former primary is brought out second set of fuse contacts, henc output from the power supply c maintained in low voltage (105 areas by switching the fuse to th ond set of contacts on the fuse

U.H.F. Converter

The "U.H.F.-70" converter c identified in Fig. 1 as the round fee-can" occupying the front- position on the chassis.

The circuitry consists of a crystal mixer, 6AF4 local osci and a 6BK7A cascode amplifi shown in Fig. 5. Output of th verter is factory-set to Channel this can be shifted easily to Cha in the field should interference lems arise. Tuning elements i mixer and oscillator circuits are ter-wave transmission lines in form (as seen on the turret i 11). Tuning is accomplished by plated slugs threaded into the lines to act as shorting bars.

Three sets of tuning elemen used in a turret-switching ar ment. In the continuous tuning tion, the slugs are driven thro gear and vernier arrangement the dual front-panel u.h.f. contr second knob on this control ac the turret assembly permitting tion of the continuous tuning ra

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1U4—64c	6F6M—52c	6BE6—54c	12AU7—62c
1U5—53c	6H6—56c	6BF5—62c	12AV7—81c
1X2A—71c	6J5—47c	6BG6—1.47	12BA6—52c
3Q4—69c	6J6—69c	6BH6—65c	12BE6—54c
3S4—65c	6K6—48c	6BJ6—56c	12BH7—72c
3V4—65c	6L6G—87c	6BK7—82c	12SA7—57c
5U4—45c	6S4—51c	6BL7—91c	12SK7—57c
5V4—82c	6SA7—57c	6BN6—81c	12SN7—62c
5Y3—37c	6SK7—57c	6BQ6—98c	12SQ7—49c
6AB4—53c	6SL7—69c	6BQ7—92c	25L6—54c
6AC7—89c	6SN7—62c	6BZ7—1.02	35W4—38c
6AG5—61c	6SQ7—49c	6C4—44c	35Y4—42c
6AH6—1.17	6T8—85c	6CB6—61c	35Z5—38c
6AK5—1.11	6U8—85c	6CD6—1.82	50A5—55c
6AL5—49c	6V6—53c	7A4—20c	50B5—55c
6AQ5—55c	6W4—53c	7A6—19c	50L6—54c
6AQ6—49c	6X4—41c	7F8—95c	117Z3—47c

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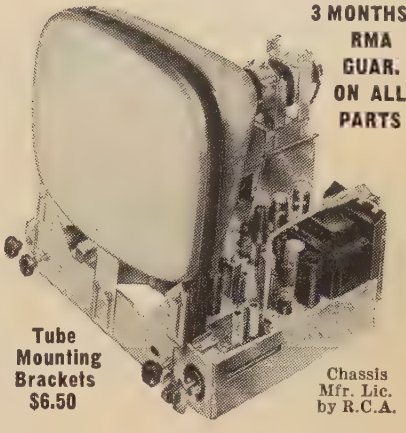

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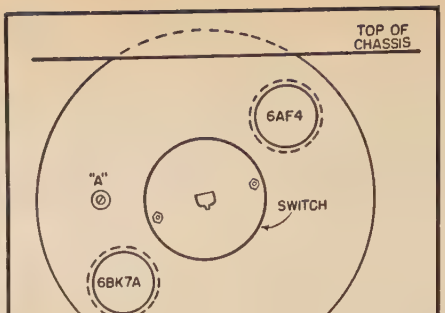

Fig. 12. Rear view of "U.H.F. 70" tuner showing location of i.f. adjustments.

the two "click" positions. A fourth position on this switch disables the u.h.f. converter and permits v.h.f. reception.

Reference to the main chassis photograph (Fig. 1) will show two openings in the front of the u.h.f. tuner which permit access to the mixer and oscillator tuning adjustments. Removal of the u.h.f. knobs on the receiver permits these adjustments to be reached without chassis removal and enables the service technician to tune the two "click" positions to local u.h.f. stations in the area. Viewed from the front, the left opening is for the mixer circuit and the right opening is for the local oscillator.

Tune-up on the click positions consists merely of first tuning the oscillator slug until the station is received and then peaking the mixer slug for maximum signal. The v.h.f. selector should be set on Channel 5 and the v.h.f. fine tuning control set to the center of its range. Two responses will be noted as the oscillator slug is turned clockwise (increasing frequency). The first response obtained as the slug is turned clockwise is the correct one. A second response will show up as the slug is turned further, this being the image response in which the oscillator is tuned above the incoming signal. It may be necessary to rotate the continuous tuning knob slightly to reach the slugs because the cam-gear arrangement covers up one of the adjustments in t course of its travel.

No adjustment is required if or the continuous tuning range is e ployed because mixer and oscilla slug tuning is ganged and tracked the factory.

When adjusting the r.f. and osc lator tuning slugs be careful not exert any pressure in the extre clockwise direction as the coil can b come distorted, making it difficult turn the slug. Also, be careful not scrape the coil loops when inserti the screwdriver. A fiber rod type screwdriver should be used.

If i.f. output on Channel 6 is quired because of a local station Channel 5, refer to Fig. 12, showi the rear view of the u.h.f. tuner, a the i.f. adjusting screws. These adju ments are underneath the chassis can be reached on most mod through the trap door opening at bottom of the cabinet. Turn core " (i.f. output transformer) three tu counterclockwise. Turn core "B" input coil) two and one-half tu counterclockwise. Since the i.f. sponse of the 6BK7A is fairly bro these adjustments are not overly cr cal.

Table 1 contains the procedure to followed when aligning the video sound i.f., and trap circuits of the ceiver. Before performing the ali ment, however, do the following:

1. Remove the plate cap from the 6CD6 horizontal output tube. Te porarily connect a 2500 ohm, 25 w resistor from the 260 volt "B+" po to chassis.

2. Remove V_{115}, the 12AT7 sync a plifier and noise inverter, from socket.

3. Turn the volume control to mi mum and the picture contrast cont to maximum. Turn the brightness c trol fully counterclockwise.

4. Set the channel selector to Channel 11 position. Set the fine t ing control to its maximum count clockwise position.

5. Allow the receiver and t equipment to warm up for twe minutes. Proceed to step 1 on Tabl

—30—

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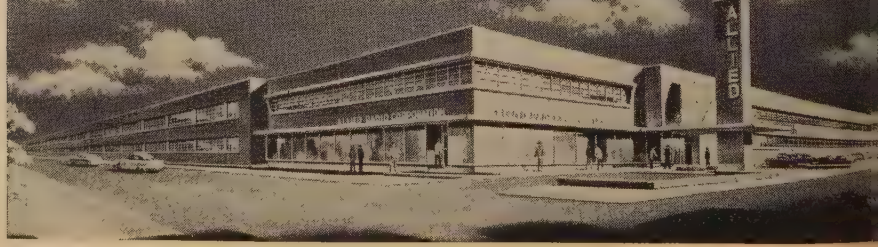

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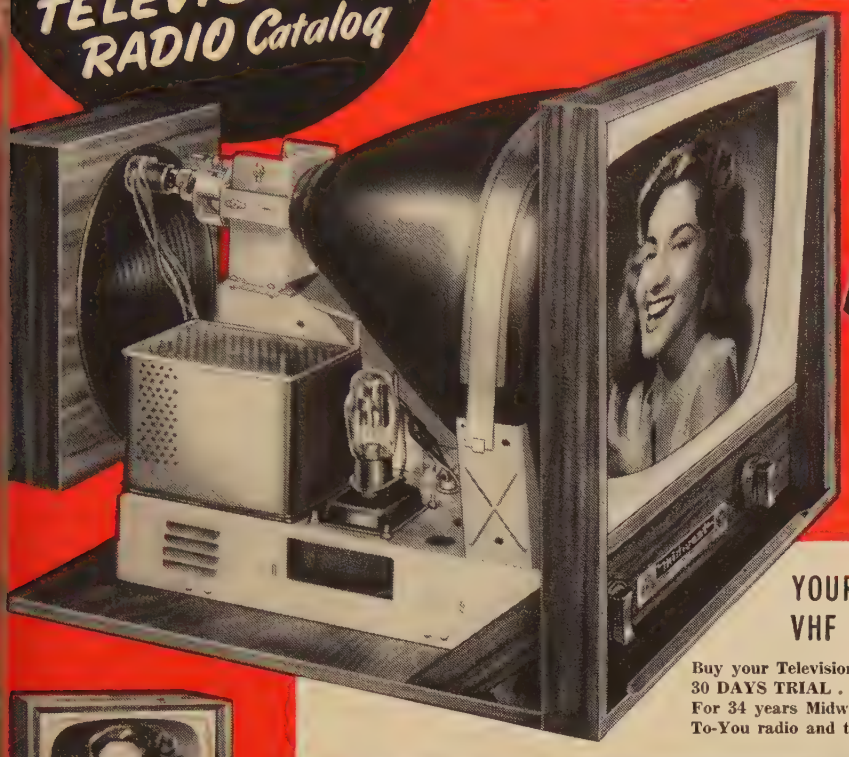

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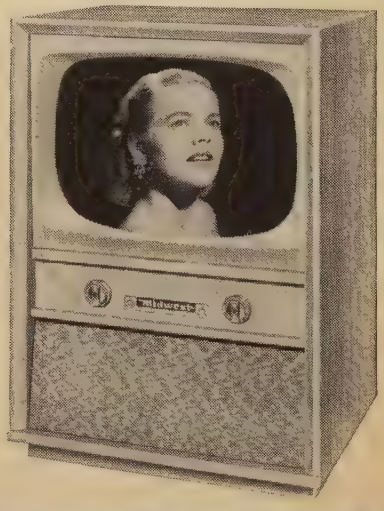

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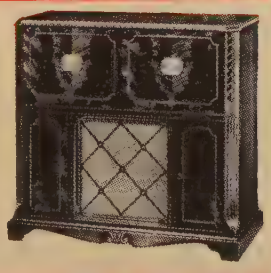

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The curves shown in Figs. 2 and 3 are taken from tests made at the Signal Corp Engineering Laboratories on units of one manufacturer of these selenium regulators. The 2X2 type consists of two selenium plates, 1¼" x 1¼", connected in series on a mounting bracket. This unit is recommended for the regulation of d.c. voltages on the order of 2 volts and constitutes the basic design of a series of regulators for other voltages. For example, units consisting of three or four plates in series are designated as 2X3 and 2X4 respectively. As more plates are added to the basic design, the regulating voltage can be extended to any practical range in the low voltage field. For good regulation, this series of regulators is designed to operate in the range of

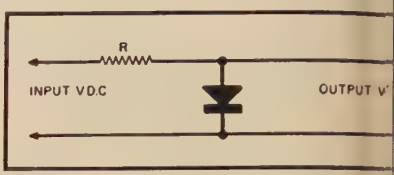


Fig. 1. A basic d.c. regulator circ

to 450 ma. In applications utilizi regulated voltage, with load cur in excess of the maximum ratin one regulator, two or more regula may be placed in series and para respectively or else one regulato another type, *e.g.*, type 2X4, 2X6, may be used.

For regulating d.c. voltages, regulator is connected in shunt Fig. 1). Regulation is accompli by utilizing the forward characte shown in Fig. 2. For example, the voltage is as required, a no current flows through the regul If, in the operation of the equipm the load current decreases, the age across the load rises. With increased voltage across the regul the regulator current will be hi However, this higher current causes a larger voltage drop a *R* (Fig. 1) and the load voltage to its normal value. On the hand, if the load current incre the load voltage will drop. At lower voltage, the regulator will less current causing a lower across *R* and thereby increasing load voltage to its original v Similarly, the regulator will keep load voltage relatively constant gardless of changes in the i voltage.

It will be noted that in Fig. 3 volt-ampere characteristic shift the right as the temperature is creased. This shift, which is

Fig. 2. Regulation characteristics for various regulators. See text for discussion.

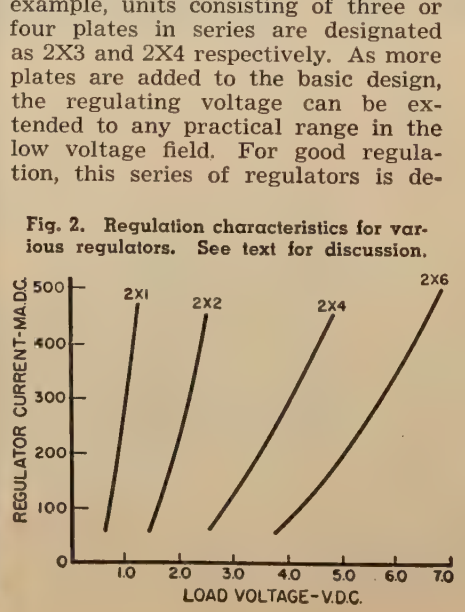
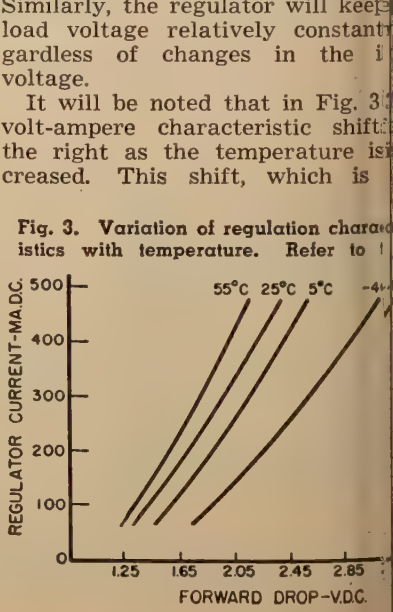


Fig. 3. Variation of regulation chara istics with temperature. Refer to



for selenium rectifiers, must be into account when designing elenium regulator into equip- It is sometimes necessary to ze the cells over the entire rature range to be encountered operation of the equipment. If s not done, the regulator, after subjected to a cycle or more of ne temperature, will shift the cteristic and consequently the ation voltage of the circuit.

se selenium regulators are pro- to operate within a small toler- band by carefully controlled ction techniques and are readily able from normal production. narrower tolerances are re- d due to rigid circuit require- , the desired units are obtain- by more careful selection with, rse, a corresponding increase in o the user.

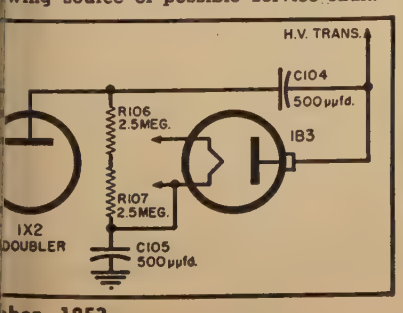
conclusion, it is recommended problems on individual applica- may best be solved by working closely with the manufacturer of selenium regulators. —30—

TV SERVICE HINT

By JACK DARR

52 17-inch Philco TV table model eiver with the D-1 deflection chas- d a very weak and fuzzy picture, he screen dark most of the time. ugh adjustment of the brightness ontrast controls would bring the e back momentarily, it would be out of focus and soon disappear. ightness and contrast controls were ed and found OK, as were all the associated with the power supply, amplifier, and video output. In deflection chassis, there was a dis- "whispering" sound such as that iated with a large corona discharge. ugh the high-voltage cage was led very well, no glow was visible; ver, the odor of ozone was quite . Finally, the set was turned on— eft on for two or three minutes. A , thin line of fire was seen crawling d the bottom of one of the 2.5- hm special filter resistors (R_{106}) in igh-voltage circuit. Tested, this or was found to be open, and the one (R_{107}) had increased to nearly gohms. The resistor had failed in- lly, and this refused to show up the fire broke through the paint. placement of this bad resistor cured rouble. These are special resistors, negohms for the 17-inch tubes, and gohms for the 20-inch tubes. They located just inside the doghouse, the 1B3GT socket to a terminal located near the top cap of the doubler. —30—

ion of the Philco D-1 chassis circuit wing source of possible service fault.



The "Con-VI"

(*Continued from page 85*)

to operate on 16 cycles, 160 cycles 16,000 cycles. These frequency n tiples were chosen to provide widest range with a minimum of o lapping within the range of the strument. The output of the o lator is fed into a 6AQ5 power plifier which produces a maximun approximately 18 volts output. calibrating control R_{12} is used to just the output in the calibrating sition S_2 to 10 volts on the v.t.v.m.

The a.c. output of the 6AQ5 appo across R_{15}. Resistor R_{15} serves to the electrolytic coupling conde charged up and prevents termina and L, and those of the v.t.v.m. being "hot." The output voltag then fed in series with either a ohm resistor to measure capacita or a one-megohm resistor to mea inductance. The v.t.v.m. is switched by S_2 to either read the put across R_{15} in the *"CAL"* posit the voltage across the 100-ohm sistor in the C position; or the vol from the L terminal to ground in L position.

A standard full-wave power su furnishes 250 volts at the outpu the filter and adequately takes of the d.c. requirements of the

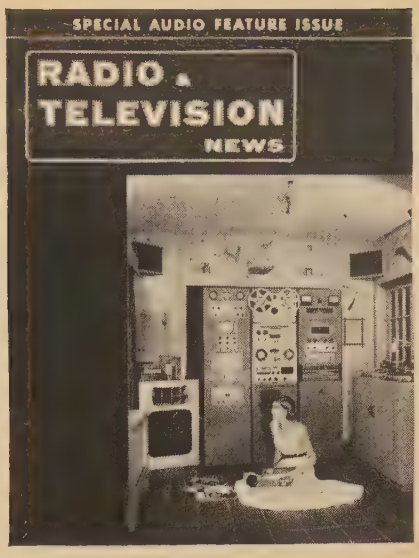
The unit can be quite comfort fitted in a 6″x6″x6″ utility cabine shown in the photographs of the The chassis is a 5″x5½″ alumin shelf fastened to the front panel. the constructor desires to use ano layout, the usual precautions ap cable to amplifier-oscillator consts tion apply, *i.e.*, keep a reasonable tance between grid leads of the 12 and any a.c. carrying leads and c ponents. More specifically, keep power transformer away from 12AT7 and switch S_1 entirely.

Another wiring precaution — one which is peculiar to this ins ment only—is to keep the inte stray wiring capacity associated the C terminal and the 100-ohm sistor, R_{16}, to an absolute minim Any stray capacitance at this p will show up on the v.t.v.m. as a pacitance, thus upsetting the accu on the lower portion of the low $\mu\mu$fd.) capacitance range.

With the meter in the .01 posi shielding of the meter leads bec mandatory to reduce stray pick *Millen* plug #37212 and terminals ilar to those used on the v.t.v.m. vide a uniform, convenient, and method of hooking up the instrum to the v.t.v.m., particularly since a.c. v.t.v.m. will probably be used other applications as well. T same terminals were used to pro a quick changeover from capacit to inductance measurement. In case, an extra *Millen* #37222 post spaced an equal ¾ inch from both C and L terminals on the panel. to change from capacitance to in

XT MONTH

th



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tance measurement, it is only necessary to remove the plug from the *C* terminal and ground and re-insert it in the *L* terminal and ground.

A replica of the scale used on this instrument is shown in Fig. 6. This chart-like scale eliminates the inevitable confusion which would result in trying to figure out which oscillator frequency setting goes with which meter setting, for what capacitance—if you see what I mean! In this case, the capacitance full scale markings are in red, the inductance in blue, and the other markings in black. This makes the scale easily readable. A piece of thin lucite is fastened over the scale with self-tapping screws.

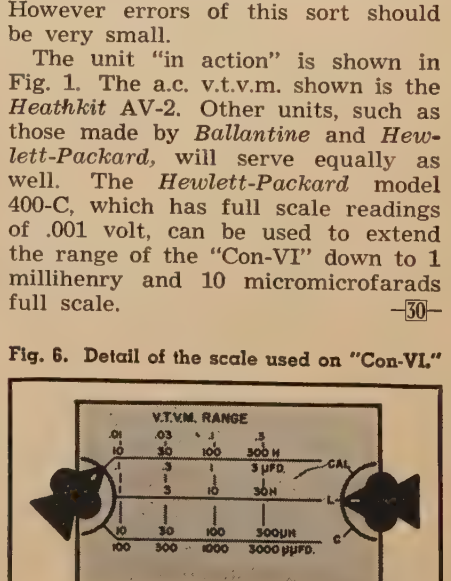
There is only one adjustment necessary on the "Con-VI" after construction has been completed. Adjust potentiometer R_7 until the waveform of the output with the unit in the *"CAL"* position is a pure sine wave. This can be observed on an oscilloscope hooked up to the v.t.v.m. terminals.

To operate the "Con-VI," hook the unknown *L* or *C* to the proper terminals, *i.e.*, between the *L* or *C* terminal and ground. Set switch S_2 to the *"CAL"* position. Adjust the calibrate control to produce a reading of 10 volts on the v.t.v.m. Set selector switch S_1 to the appropriate range. This also indicates the correct v.t.v.m. range. Set switch S_2 to either *L* or *C*, as the case may be. Read the v.t.v.m. meter scale, and that's it. Actually the procedure is a lot simpler to do than describe.

To compensate for small errors and variations in the oscillator frequency and the v.t.v.m., the output voltage in the "calibrate" position can be varied from the 10 volt setting previously described. Just how much the 10 volt setting should be varied can be determined by substituting a known condenser and adjusting the calibrate control to produce the exact value reading on the v.t.v.m. Switching back to the *"CAL"* position will show how much compensation is necessary. However errors of this sort should be very small.

The unit "in action" is shown in Fig. 1. The a.c. v.t.v.m. shown is the *Heathkit* AV-2. Other units, such as those made by *Ballantine* and *Hewlett-Packard*, will serve equally as well. The *Hewlett-Packard* model 400-C, which has full scale readings of .001 volt, can be used to extend the range of the "Con-VI" down to 1 millihenry and 10 micromicrofarads full scale. —30—

Fig. 6. Detail of the scale used on "Con-VI."



Spot Radio News

(Continued from page 18)

e any revolutionary new devel- ts insofar as systems are con- , which would suggest any rea- r changing these standards at me in the forseeable future."

balky problem was cited in this rting bid for color; the color Thus far, this manufacturer ed, the tubes demonstrated and hich . . . "production plans have asserted, give only a small pic- and are complicated and costly duce." The big job ahead, they evolves about the development . . "simplified, large-screen color that can be manufactured at nable cost." Such a project, they will involve a . . . "great deal vention and engineering work." ver, they added, it is felt that it d be possible to meet this goal n two or three years.

compatible color set and par- rly its variable design features, ble because of the flexibility of proposed standards, were aptly bed in the petition, too. Noting there is . . . "considerable lee- n the design of receivers in use the NTSC standards . . ." it was d that it is likely that . . . ufacturers . . . will have dif- t ideas as to the optimum de- of color receivers."

e Commission has received one set for test and is expected to many more during the next few s for study. All will be probed ase of operation, lack of critical controls and registration, and rospective cost to consumers.

ce of the extremely bright items he color front was announced a lays before NTSC filed. The tele- e company labs declared that they developed a wide-band coax car- system; a 4.2 megacycle affair, d the L-3 design. The labs say the system has been so designed high quality results will obtain 4000 miles of transmission. Fea- d in the new link are line repeat- spaced at approximately four- intervals, and connecting termi- r dropping repeaters. In addition, the route, are equalization ment, power generating, and r transmission plus maintenance pment, at 100 to 200-mile inter-

is new broadband transmission m will not only insure a striking ity to networked color signals, to black and white transmission, it represents nearly a 100% im- ement over the present cables.

hile color broadcasting does not lve too many changes in the ac- transmitter, an array of comple- tary equipment is required for up and feed. According to one lier, several assortments will be lable, depending on the specific casting schedules involved. For

broadcasting of network programs only, necessary equipment will include two color-stabilizing amplifiers, and a tri-color monitor with picture tube. For locally-originated color programs, gear needed can include a color slide camera chain, a color film chain, color studio-camera chain, which can consist of a color camera without or with three matched image orthicons. In addition, stations will need test equipment featuring a color bar generator.

Many TV casters are so convinced that the big push in color will begin next summer that they have already entered their orders for local and network equipment. Set makers are equally optimistic, declaring that at least 50,000 tri-color receivers will be made in '54.

SUBSCRIPTION TV and theater TV, a couple of acute headaches plaguing the Commission, have dropped into the halls of Congress and attracted the attention of a Representative from California, Carl Hinshaw. Feeling that both of these forms of transmission are beyond the spheres of actual broadcasting, he has introduced a bill asking that they be placed in the public-utilities category, so that the FCC can set tariffs and rates for types of service rendered, with return entitled on investment as a consideration for such schedules.

The measure, under study by the House Interstate and Foreign Commerce Committee, could prevent the Commission from approving subscription TV as a division of broadcasting.

Presentation of the bill will also probably postpone any immediate consideration of "pay-as-you-see" TV by the Commission, since now FCC members will probably be called on t testify before the House committ and they will not meet again u next year when the second sessio the 83rd Congress convenes.

The Congressman declared that offered his bill to permit a clarifi tion of the law involving charges radio or TV programs. He also that pay-TV should be probed by C gress since it introduces a new of public service, warranting st control. Several members of the H committee concurred in this view, undoubtedly next winter will se full-scale review of the subject.

EDITOR'S NOTE: *For details on type of "pay-as-you-see" telev system see "Skiatron's Subscriber sion," page 58 of this issue.*

In the meantime, the FCC has b requested by four ultra-high-cha holders to approve the use of scription TV on their stations. Su plan, it was said, was urgently nee now, for it would enable these br casters to meet competition from n work stations operating on the st ard bands.

Those who made the plea inc the *Home News Publishing Co.*, Brunswick, WDHN-TV, Channel *Pennsylvania Broadcasting Co.*, P delphia, WIP-TV, Channel 29; *S ford-Norwalk Television Corp.*, S ford, Conn., Channel 27; and *Con ticut Radio Foundation*, New Ha WELI-TV, Channel 59.

COMMUNITY TV, another prob child, has appeared on the FCC do during the past few weeks. An a cation has been received from *Mountain States Telephone and graph Company*, in Denver, asking permission to build six micro

NEW TV GRANTS SINCE FREEZE LIF

Continuing the listing of construction permits granted by FCC sinc lifting of freeze. Additional stations will be carried next mont

STATE	CITY	CALL**	CHANNEL	FREQUENCY (mc.)	POWE (Video
Illinois	Champaign-Urbana	.....	21	512-518	16.2
Maine	Poland	.....	8	180-186	105
"	Portland	WCSH†	6	82-88	100
"	Lewiston	WLAM†	17	488-494	15.8
Massachusetts	Brockton	.....	62	758-764	195
Mississippi	Jackson	WSLI†	12	204-210	214
Nebraska	Kearney	.....	13	210-216	56.2
New York	Utica	.....	19	500-506	52.5
North Carolina	Wilmington	WMFD-TV†	6	82-88	53.1
"	Winston-Salem	.....	12	204-210	316
Oklahoma	Oklahoma City	.....	9	186-192	316
South Carolina	Greenville	.....	4	66-72	100
"	Spartanburg	.....	17	488-494	105
Tennessee	Nashville	WSIX†	8	180-186	316
Texas	Midland	.....	2	54-60	10
"	Weslaco	KRGV-TV†	5	76-82	28.8
West Virginia	Fairmont	WVVW†	35	596-602	17.4
Virginia	Portsmouth	WLOW†	27	548-554	89.1
Alaska	Anchorage	..... (Sharing air time with)	2	54-60	13.8
"	Fairbanks	.....	2	54-60	13.8
"	Anchorage	.....	11	198-204	18.2

***ERP = (effective radiated power, kw.). . . = Call letters to be announc**
† = Temporary call letters.

stations which would furnish view in Casper, Wyoming, and surround towns with signals from Denver Laramie. Distance between relay s tions near Laramie and Casper is o 100 miles, over mountainous terrain

The route described, which r parallel to an existing toll line, wo be equipped with alarm circuits to sure operation.

For over a year the Commission had a similar proposal from a gr in Poplar Bluff, Mo., who also w interested in erecting microwave lays to serve those in Kennett Poplar Bluff.

Since common carrier services involved, the Commission must termine rates, classify types of s ice, and consider too, if the rela programs would create unfair c petition for those who might ins TV stations, as well as those who h already received permission to bu

The Hinshaw proposal to amend Communications Act, placing all t of charge service under a pu utility format, has also concerned Commission in this matter, and probably delay consideration of applications until Congressional ac on the House measure is taken year.

MOUNTAIN-TOP transmission, tured by scores of TV stations, highlighted recently in the approva Channel 8 to *Mt. Washington*, The official grant noted that the tion, with studios at Poland, Ma and transmitter atop towering Washington, New Hampshire, serve a radius of 100 miles.

Maine found itself a headline the TV station approval list as summer came to a close with t grants; two for low-band and one the higher channels, or 6, 8, and as noted in the station table on 166.

MORE DOLLARS, to ease the TV application load, appeared in appropriations bill that was si by the President.

Specifically, the Commission ceived $900,000 more than it got the fiscal year '53. The addition cording to Senator Johnson, will it possible to hire 14 more exam teams to process applications. will give the Commission a total teams for the huge job of spee up grants.

ONE OF TV's greats, youthful T. Farnsworth, received the pla of broadcasters recently during a quet in his home state, Utah.

Hailing the inventor, Harold E. lows, prexy of the National Ass tion of Radio-Television Broadca called him . . . "a giant among uses whose inventions have modern-day television possible."

Farnsworth, who was born Beaver, Utah, was described as o of over a half-dozen basic TV pa used in practically every chassis,

100 patents on electronic de-

izahs to this bold pioneer whose g resourcefulness has helped to new frontiers, bringing better ng to all . . . . . L.W.

TRANSISTOR CATHODE FOLLOWER

By A. H. HELLMERS

transistor equivalent of a cath- follower is the grounded-collec- rcuit, more recently known as emitter-follower". The accom- ng circuit gives practical circuit nts for a general-purpose emit- lower using a *Raytheon* CK722 " junction transistor.

gain of this circuit was meas- at over 0.98, comparing very ably with tube circuits. The in- impedance is, however, much . Input impedance values, rang- om 100,000 to 200,000 ohms, were ured with several transistors of me type. In this type of circuit, nput impedance is nearly equal e collector resistance, *i.e.*, the mic resistance between collector ase. This dynamic resistance ac- y shunts the input circuit, as can en from the circuit diagram, and egeneration in the emitter cir- can do nothing to reduce this ing effect. The published value ollector resistance for junction istors is usually around 10,000 , but an operating point can us- be found at which the collector ance is higher, as in the present

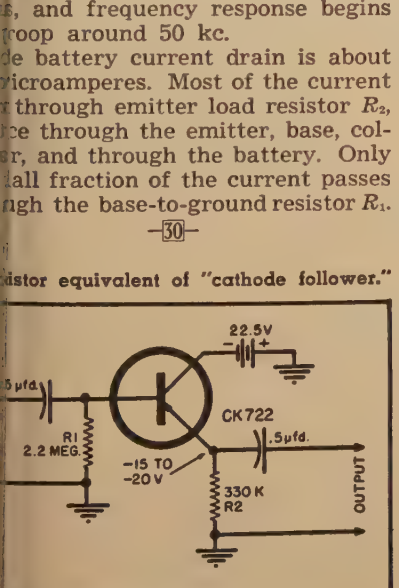
e input resistance can be meas- by inserting a variable resistor ries with the input and finding ial the value required to reduce utput signal by half. The emitter or R_1 will require some adjust- to get the highest input imped- for any particular transistor. The plan is to try several resistors ng from 1 megohm to 3.3 ohms.

utput impedance is around 10,000 s, and frequency response begins roop around 50 kc.

de battery current drain is about icroamperes. Most of the current through emitter load resistor R_2, e through the emitter, base, col- r, and through the battery. Only all fraction of the current passes gh the base-to-ground resistor R_1.

—30—

istor equivalent of "cathode follower."



AN ADJUSTABLE REGULATED VOLTAGE SUPPLY

By J. J. HOEFER, W

Increase the versatility of your 300-volt power supply by adding this circuit to give 30, 75, 105, 180, or 255 volts!

OCCASIONALLY, for the workshop, lab, or ham shack, a regulated power supply which has an adjustable output available is needed.

Using four voltage regulator tubes, a switch, and a few resistors, the gadget described may be attached to any 300-volt supply to obtain several regulated voltages.

Before proceeding with a description of such a unit, let us review some fundamentals.

Fig. 1A shows the basic voltage regulator circuit. The supply voltage must be approximately 20% in excess of the regulated voltage required, in order to cause the VR tube to fire.

The resistance R_1 is determined by the supply voltage, VR tube type, and current through the load R_2. Thus, for a supply voltage of 250 volts, a VR150, and load current of 25 ma., and since approximately 5 ma. must flow through the VR tube to keep it fired, R_1 must be 100/.030 or 33,000 ohms at more than 3 watts.

If the load is removed by opening S_1, the load current must flow through the VR tube. This value of current must not exceed the tube's maximum value permitted, usually 40 ma.

Referring to Fig. 1B it is seen that the load current must now flow through VR_2 whenever S_1 is closed.

If this load current is within the capabilities of the VR tube, a constant voltage drop appears across VR_2 and the voltage appearing at the load is less than that across VR_1 by this amount.

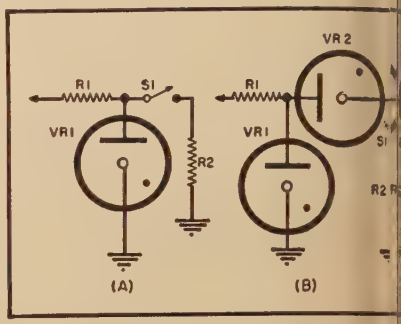


Fig. 1. (A) Basic voltage regulator circ (B) Another version of a voltage regula

For example, assuming the va as calculated before, and VR_2 VR105, the voltage appearing ac the load is 45 volts.

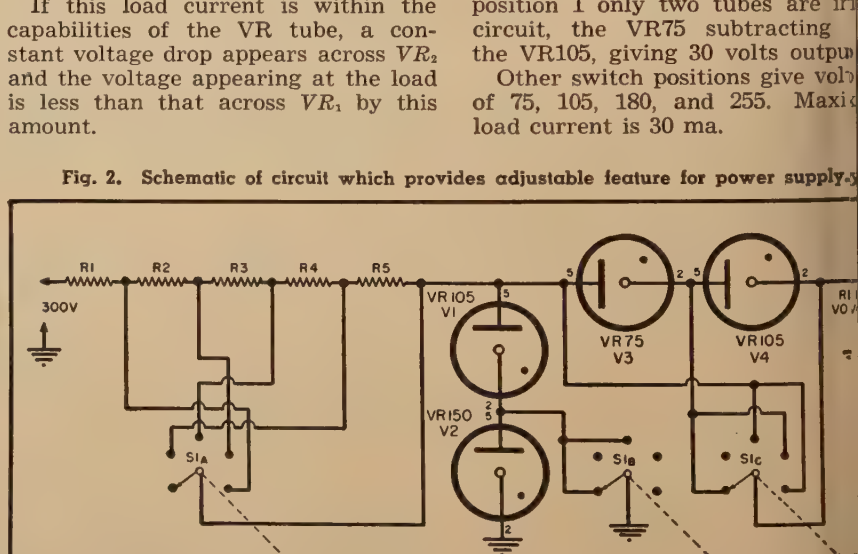
Note that the 45 volts is a r lated voltage. If VR_2 is replace a resistor of sufficient rating to the load voltage to 45 volts, the voltage will change with varying current, and cease to be a regu voltage.

More than one VR tube ma added in series with VR_2, furthe creasing the load voltage; more tubes may be added in series VR_1, increasing the load voltage.

Now refer to Fig. 2 for the matic diagram of the unit. In sw position 1 only two tubes are in circuit, the VR75 subtracting the VR105, giving 30 volts outpu

Other switch positions give vol of 75, 105, 180, and 255. Maxi load current is 30 ma.

Fig. 2. Schematic of circuit which provides adjustable feature for power supply



R_1, R_5—1200 ohm, 2 w. res.
R_2, R_3—1950 ohm, 2 w. res. (two 3900 ohm res. in parallel)
R_4—820 ohm, 2 w. res.

S_1—S.p. 5-pos., 3-gang sw.
V_1, V_4—0C3/VR105 tube
V_2—0D3/VR150 tube
V_3—0A3/VR75 tube

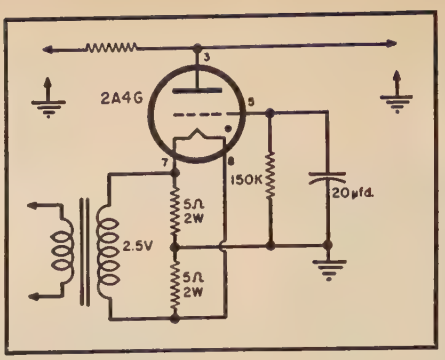


Fig. 3. Alternate circuit using a 2A4G.

Resistor values are shown for a 300 volt input, but by employing the relationships set forth earlier in this article their values may be calculated for any supply voltage.

Much more elaborate switching circuits may be employed with these and other tubes for a larger number of steps, but it was felt the steps shown represent a good compromise between complexity and versatility.

For those who wish to design their own circuits it should be pointed out that the 2A4G makes a good VR150.

A supply was built using three 2A4G tubes, a VR105, and a VR150, with the output variable in 15 volt steps from 15 to 300 volts.

Special connections for the 2A4G are shown in Fig. 3. Its major disadvantage is that separate filament windings are needed for each tube.

Another possibility for a VR tube is the common neon bulb. Current ratings are small, however. The NE-48 has a nominal current rating of 2 ma. and will maintain approximately 75 volts across it.

The useful life of these neon bulbs varies inversely as the cube of the current, consequently doubling the current reduces the life to one-eighth of the normal value.

As has been shown many times, a simple relaxation oscillator may be built using a VR tube circuit with suitable values of capacity across it.

Therefore a word of warning is in order. Do not exceed the value of capacitance across the VR tubes, as stated by the manufacturer, or unwanted oscillations may occur. For most VR tubes this is .1 μfd.

For a simple to build, inexpensive unit, this circuit offers you a handy gadget for the work bench. —30—

STATIONS JOIN NET

AT.&T. has connected six more stations into its nation-wide network facilities. Stations WTVI, Belleville, Illinois; WGVL, Greenville, S. C.; KBES-TV, Medford, Oregon; WHB-TV and KMBC-TV, Kansas City; WBUF-TV, Buffalo; KEDD, Wichita, Kansas; and WETV, Macon, Georgia, are now tied into the network.

With the addition of these stations network programs are now available to 154 stations in 103 cities in the United States. This figure includes installations made by the Bell System up to and including August 24th.

—30—

Color TV

(Continued from page 53)

...rious transition from a 5-tube ... a 25-tube TV receiver. The ...al 15 to 25 tubes required by ...receiver are, in some circuits, ...re of the same. However, in ...rcuits there are new concepts, ...erstanding of which is essen... the proper diagnosis of trouble. ...present stage of color receiver ...ment, color adjustments are ...ely critical, requiring a broad ...dge of color circuitry. Service ...ians will have to study such ... conscientiously to be success... this field.

...is point the writer would like ... a small prayer on the service ...ian's behalf. Knowing that ...ervice test and alignment equip... will be required in working with ... receiver let us hope that the ...rs of this test gear (it has ... been designed) will keep down ...e and weight. In the same ... let us pray that the designers ...e new color receivers allow for ...shooting in the home and in ...inet. These larger chassis are ...rably heavier than black and ... chassis with half their tube ...ment. A combination of lighter ...ear and a chassis which could ...oubleshot" in the cabinet will ...or fewer ruptured service tech..., fewer chassis dropped down ...airs, and what is not a negligible ... in service technician-customer ...ns, smaller service bills.

... article has attempted to dispel ...g that has shrouded the color ...icture. Considerable progress ...en made in the formulation of ...proved compatible color signal. ...applications for a "Change of ... have been filed with the FCC. ...rst was made on June 25, 1953 ... A, and the second by the NTSC ...onth later on July 23, 1953. In ...ase a request was made to have ...present monochrome standards ...led to provide for color TV trans...ns in accordance with the new ... signal. FCC approval is ex...d by the first of the year or ...y thereafter.

...eiver production should start ... in the fall of 1954 with a price ... of $750 to $1000. This price ... is expected to fall as develop...al work continues. One labora... has already produced an experi...al receiver which requires only ...bes.

...t 2 of this series will discuss ...olor signal in detail and examine ...ical color receiver.

REFERENCES

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...essler, Robert: "The PDF Chromatron ...A Single or Multi-Gun Tri-Color Cath...e-Ray Tube," Proceedings of the IRE, ...y 1953.

(To be continued)

SIMPLE SPEEDLAMP TESTI

By **ALLAN M. FERRES**

This easily-built unit can mean more dollars for the shop owner. Servicing speedlamps is easy and quite profitable

SURE-FIRE operation of electronic speedlamps is imperative for both the amateur and professional photographer. This requires careful testing of the flash unit, especially after a repair or adjustment has been made or a new tube installed. One successful repair service operates the speedlamps two hundred times at their rated recharging time. If the light continues to operate during this test it can be assumed that it will function properly on the job. This service shop has the agency for a professional speedlamp which has a recharging time of 15 seconds. This simple tester was designed to perform this test automatically to relieve the technician of a monotonous and time-consuming task. Reliability and low cost were two definite requirements of the test unit, together with a reasonable interval accuracy. This device fulfills all three requirements adequately and is easy to build and operate.

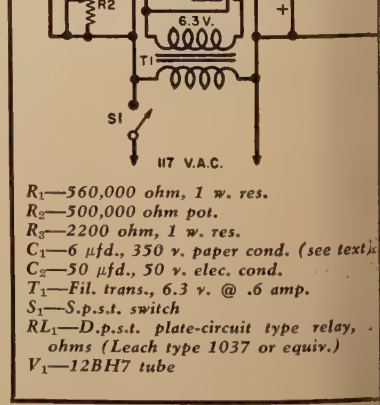
The speedlamp itself consists of a wet-cell battery operating a vibrator in the primary circuit of a high-voltage transformer. The high voltage is rectified and used to charge two high-capacity condensers in parallel. The switch on the camera shutter operates a relay which connects the condensers in series across the flashtube. When the flash unit is operating properly, the condensers can be fully charged in 15 seconds and are capable of firing the tube. If the tube cannot be fired in 15 seconds, trouble is indicated. What is needed is a set of contacts to take the place of the switch on the camera.

The test unit is built around a double-pole, single-throw plate circuit relay and a dual triode. The first triode section of the tube, V_{1A}, has its cathode connected to one side of the 117-volt a.c. line; the plate, in series with the relay coil, connects to the other side of the line. The grid return is through R_1 and R_2 in series to the cathode. Across the two grid resistors is connected 6 μfd. of capacity, made up of a 4 μfd. and a 2 μfd. in parallel which were picked up on a "surplus" bargain counter. The other section of the tube, V_{1B}, is connected as a half-wave rectifier with the plate and grid tied together and connected to the arm of the "A" set of relay contacts. The cathode is connected to the line side of the relay coil. A 50 μfd., 50-volt electrolytic condenser is connected across the relay coil to prevent the relay from chattering on the pulsating d.c. R_3, which is between the normally-open contacts of the relay and grid of V_{1A}, reduces the surge current through the rectifier section and holds the relay closed long enough to insure positive action of the speedlamp. A 12BH7 was selected as the tube due to its ability to stand a high negative pulse on its control grid.

The operation of the circuit is extremely simple. When the test unit is first turned on, no bias is applied to V_{1A}, and when the tube has reached operating temperature, sufficient plate current is drawn to operate the relay and close the contacts. When the relay contacts close, about 150 volts negative from V_{1B} are placed on the grid of V_{1A}, cutting off the plate current and charging C_1. Cutting off the plate current causes the relay to open. The relay remains open until C_1 has charged through R_1 and R_2 to about 6 volts, the bias which will permit enough plate current to flow to operate the relay again. The cycle is then repeated. The arm of the normally open "B" contacts of the relay is connected to a jack suitable for a lead which would normally connect to the camera shutter.

The interval between the momentary closings of the relay contacts depends upon C_1 and the sum of R_1

Complete schematic of compact tester



R_1—560,000 ohm, 1 w. res.
R_2—500,000 ohm pot.
R_3—2200 ohm, 1 w. res.
C_1—6 μfd., 350 v. paper cond. (see text)
C_2—50 μfd., 50 v. elec. cond.
T_1—Fil. trans., 6.3 v. @ .6 amp.
S_1—S.p.s.t. switch
RL_1—D.p.s.t. plate-circuit type relay, ohms (Leach type 1037 or equiv.)
V_1—12BH7 tube

maximum charging voltage on the maximum bias which permits enough plate current to flow to operate the relay. After the tester is adjusted, clip a piece of paper between the contacts so that they won't close and then plug it in to an a.c. source. When the tube warms up, the relay should close. If it doesn't, release the spring tension and, if necessary, bend the stop so that the armature is closer to the pole piece. The relay should close with a definite snap. Then turn to minimum resistance and pull the paper from between the contacts. The relay will spring open and after a few seconds close and open immediately. With a stop watch or the second hand of an electric clock, check the length of time between the relay openings. Increasing the resistance will lengthen the interval. If the minimum interval is too short, increase the value of R_1 and if the minimum interval is too long, reduce R_1. In the original tester, a variation between 12 and 20 seconds was obtained with the value of R_1 560,000 ohms and R_2, then, serves as a vernier whereby the exact timing can be easily adjusted to the operating interval required, in this case, 15 seconds. If a much longer interval is required, such as several minutes or more, C_1 can be changed to 1 mfd.

The parts are mounted in a 6" x 6" x 3" steel utility box in any convenient arrangement, as lead length is not critical. *Do not* connect any part of the circuit, except the jack, to the metal case, as a severe shock hazard will result due to the direct connection of the circuit to the 117-volt line.

—30—

THAT WORD "HAM"

In the "Short Wave Magazine" of England, we reprint one of the recent "Com Jottings by the Old Timer," which will be of interest to American hams:

"Readers cannot have failed to notice how the word 'ham' appears extremely often in this publication. One of the reasons, no doubt, is that there is certain lack of dignity about that slang expression, and its traditional meaning is completely lost on the uninitiated, who regard a 'ham' in radio as being quite like a 'ham' in the acting profession. I am very strongly of the opinion that we should make more use of the word but only in very privileged cases. The 'ham spirit' used to be proverbial, embracing all that was best and friendliest in amateur radio. Much of the true old 'ham spirit,' alas, has now been lost. As a start towards reviving it, I suggest that only the very best of amateurs should be honored by the term 'ham,' which should imply that a person so designated is one of the real 'good fellows.' Most of us are only 'amateurs' at amateur radio, but a ham has progressed well beyond this stage; he gives his best in every way he can, his behavior at all times is faultless, he never radiates a bad signal, and he never makes a nuisance of himself in any way. There are very few of him about—are YOU one?"

—30—

(*Continued from page 67*)

of enclosure by closing Ports *A* a to position *S-S*. The reflex Port also completely closed. Approxim 11 cubic feet are provided for o tion as an infinite baffle.

Bass Reflex

Well designed bass reflex cab are capable of excellent results. manufacturers provide such cab to accommodate their loudspea However, they sometimes compr between optimum performance space requirements because no customers will tolerate a cabini large as is necessary for best po results. The *"Fold-a-flex"* provid alternate choice of two cabinet umes.

Bass reflex performance is obt in the *"Fold-a-flex"* by closing *A* and *B* in positions *S-S* and by ing the port for correct reflex a Details on this tuning will be cussed in a subsequent article port is placed close to the loudsp opening so as to take advantage radiation impedance (in-phase taneous compression of the ai tween the two openings tends to force the transfer of energy t air).

Folded Horn

Various types of corner ca have achieved great popularity cent months. The *"Fold-a-flex"* braces a true folded horn when *A* and *B* are placed at position and when reflex Port *C* is clos tuned in conjunction with the characteristics. By placing the e ure in a corner, two walls of the will extend the effect of the horn. When placed against a flat there is sufficient horn loading t vide very clean response well 50 cycles. It is entirely possib combine the bass reflex principl the folded horn design.

Construction

The dimensions shown for the *a-flex"* are typical for 15-inch ers. *Kimsul* blocks are placed a dom throughout the inside of the net walls to prevent standing within the cabinet. Two inch *F* is placed at the apex of the within the cabinet directly back speaker. Braces of 1X2's may b ed at random angles within the net to offset cabinet resonance encies.

The partitions extend the full height of the enclosure and thes be ⅝ inch plywood. The main c structure and the removable baffle are constructed from ¾ plywood. Gaskets are used Ports *A* and *B* to insure an a seal.

Two vertical slots are located cent to the front mounting baff

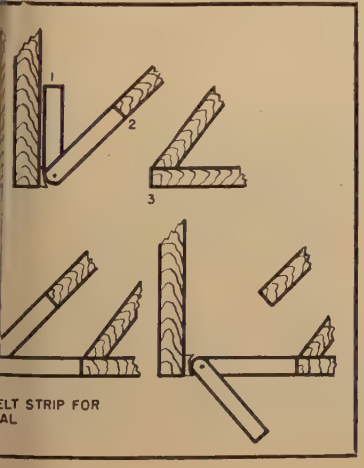
piece of plywood shown in ings may be moved up and ctly back of the reflex Port by loosening the two knobs, e port, and then tightening s which permit the slide to ly held in any chosen posi- s imperative that any reflex be tuned to the speaker for results.

proved model of the *Read lex"* utilizes a modification of and *B* as shown in Fig. 2. the hinged edge of the ports ded and that a ⅛ inch felt lued to the inside of the cabi- ng as an air seal regardless sition of the ports. This tech- o provides a braking action the ports in any chosen po- Modified Ports *A* and *B* are ed like a "V" and the follow- n results: when set in Posi- he characteristics of the en- will be that of a folded horn. Position 2, the air volume of net is decreased to provide loading for the cabinet when a bass reflex and also to pro- er characteristics for 12-inch . When Ports *A* and *B* are t Position 3, the total air vol- the enclosure is available to an infinite baffle character- s a reflex using large air vol-

the modified construction of s does present a greater con- problem, it will be well e effort for the experimenter om installer as it will provide est possible choice of baffle ristics for the demonstration fidelity equipment. With these le ports at your fingertips aker characteristics can be to create the most pleasing

quent data will appear giving ails for construction of this en- design for both 12-inch and speakers including the coaxial as two- and three-way speaker . Measurements are now being several representative speak- performance curves will ap- later issues. —30—

n experimental model of the "Fold- with a modification of Ports A, B.



LT STRIP FOR AL

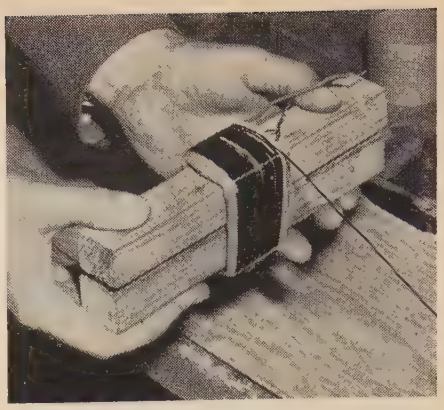


Fig. 1. Winding the new secondary. The block of wood prevents damage to wire.

USE YOUR DEFECTIVE TV TRANSFORMER

By

HENRY A. SETZKE

Discarded components can be utilized to build this hand variable voltage transformer for service shop test work

THE piece of equipment to be described should be standard equipment for every service technician. It is as necessary when testing television receivers as when servicing a.c.-d.c. radios and the like. The variable line voltage transformer can be used to test for voltage-surge intermittents, excessive bleeder resistance drops, and many other defects. It is also useful for isolation purposes. The particular unit described here can be constructed from any ordinary defective TV power transformer.

The power transformer from a TV set is desirable because it is designed to supply 250 to 300 watts and therefore is capable of delivering this much power after it is rewound. Most defects in TV power transformers occur as a shorted or open high voltage winding. The transformer selected must have this type of defect because all the windings except the high voltage one will be used again.

The first step is to disassemble the core. While removing the core laminations carefully observe the way the core was constructed; later it must be replaced the same way, see Fig. 2. Care should be taken when removing the laminations so that they are not bent or damaged in any way.

The second step is to remove the defective high voltage winding *without disturbing the other windings*. The high voltage winding will be the winding with the smallest diameter wire. All insulating paper should be saved for later use.

If the high voltage winding is the outermost winding it should be removed up to and without disturbing the insulation which separates the high voltage coil from the next coil. The new secondary can then be wound directly upon this insulation using the inner coils as a coil form. A block of wood one foot long through the center of the coil will make winding easier and also prevent damage to wires from the other coils during the winding process. See Fig. 1.

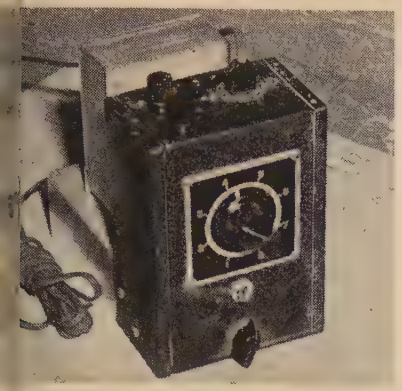
If the high voltage winding is the innermost coil a slightly diffi procedure must be followed. The are always wound upon a heavy board form; since the cardboard will be used with the new coil, should be taken when removing single cut with a razor blade or knife should be made, and the board form carefully removed. the high voltage winding is remov to the insulation that separate high voltage coil from the next A block of wood about one foot and the same dimensions as th side of the cardboard form, will winding the coil easier. Two or pieces of wood may be used to g desired size, see Fig. 1.

The third step is to determin number of turns needed for the secondary. After the high v winding is removed the "volt secondary-turn" can be deter by temporarily winding 10 full of #18 enamel covered magnet around the windings that are le temporarily replacing the core terial. Connect the primary t line and accurately measure the age of the 10-turn winding. "volts-per-turn" is this voltag vided by 10.

The number of turns for the secondary coil can be determin dividing 120 by the "volts-per- About 125 feet of wire will b quired. The coil can be wou either direction, but when once s the direction of winding shoul

Fig. 2. How transformer core is disasse

anged. A thin layer of insulat- paper should be placed between



3. Over-all view of unit showing com- size. A meter can be added if desired.

rs. The coil should be tapped at olts from the end. The number urns from the end where the tap ld be placed can be determined viding 10 by the "volts-per-turn." tap is twisted together, insulated, the remaining wire wound over it hown in Fig. 1. After the new is wound on the cardboard form, ating paper should be used to l up the size so that it fits firmly le of the old coils.

he fifth step is to connect the sec- ry windings in series aiding and ring the connecting points out to a ch. (See Fig. 4.) If there are more ndaries than the customary 6.3 and 5 volt windings more taps be added. With the minimum ber of secondaries the circuit ld be wired as shown in the cir- diagram, Fig. 4.

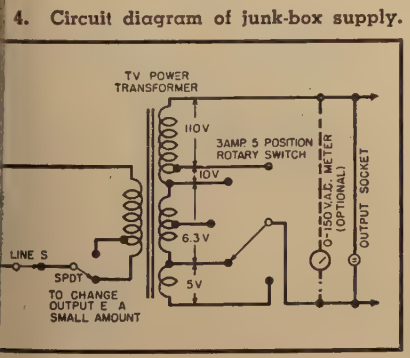
b help connect the secondaries perly, an a.c. voltmeter should be . If it reads 113.7 volts when the volt and 6.3 volt windings are ed in series, it means the wind- are in series opposing. To cor- this interchange the 6.3 volt s. The voltage should then read 3 volts. The same procedure is owed with the 5 volt winding.

0-150 volt a.c. meter may be con- ed across the secondary of the nsformer as shown in Fig. 4 to give ntinuous indication of the second- voltage.

iaking into account the small out- of cash and time required to build unit, this is a worthwhile project n every standpoint.

—30—

4. Circuit diagram of junk-box supply.



The OARAC

(*Continued from page* 83)

linder passes under a magnetic head only once for each revolution of the cylinder, it is not possible to read any arbitrary spot at any arbitrary time. It may be necessary to wait up to a full revolution before the desired spot passes beneath a magnetic head. Since the cylinder rotates at 3350 rpm or approximately 56 revolutions per second, one revolution takes 1/56 second or approximately 18/1000 second which is 18 milliseconds. This is the maximum access time for the memory. The waiting time for the desired spot (or more properly "word" since a full word is always read at one time) to be read may vary from zero up to the maximum access time of 18 milliseconds, hence it is useful to speak of the average waiting time. This is just ½ the maximum access time, thus we say that the average access time is 9 milliseconds.

Turning away from the OARAC memory our layman encounters a large cabinet filled with vacuum tubes, germanium diodes, and associated electronic components not to mention an almost undecipherable maze of wires. The contents of this cabinet are primarily the arithmetic and control circuits of the computer. In spite of their electronic complexity, the basic functions of these circuits are quite simple. Let's consider the arithmetic unit first.

The arithmetic unit is that part of the computer which does the arithmetic calculation. It may be compared to a very high-speed desk calculator which is capable of adding ten-decimal-digit numbers in about 90/1,000,000 of a second, or in computer language, 90 microseconds. A multiplication of two such numbers takes approximately 8/1000 second or 8 milliseconds.

The main components of the arithmetic unit are three storage registers, an adder, and a counter. The storage registers are electronic circuits (each contains 44 tubes plus 352 germanium diodes and associated components) each of which is capable of storing one ten-decimal-digit number, or word as it is sometimes called. These registers are used to store numbers temporarily while the arithmetic operations are being carried out. The adder may be compared to an electronic addition table. When electrical signals representing two numbers are fed to its input an output signal representing the sum of the two numbers appears at its output terminals. When the adder is properly connected to one of the three storage registers, the numbers stored in the registers are added and the sum is stored in one of the registers. Subtraction is accomplished by first making one of the numbers negative and then adding them.

Multiplication is accomplished by means of repeated additions. For example, $7 \times 3 = 21$ may be written $7 + 7 + 7 = 21$. Using this method multiplication makes use of the adder and the counter is used to keep track of the number of additions that are made. This is a somewhat simplified

Close-up view of plug-in turret used in the OARAC electronic calculator.

Mathematician and typist with the output unit set up problem to be sol

of how the computer actually ies, but it serves to illustrate ic principle involved.

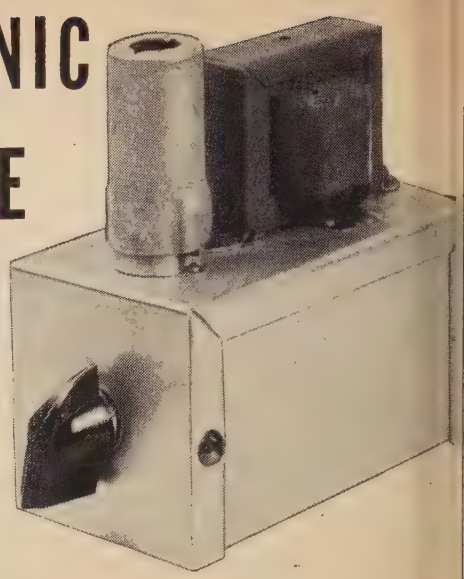
control circuits of OARAC may ded into two parts—the arith- ontrols and the sequencing cir- The arithmetic control circuits he necessary signals to the etic unit to cause it to add, t, divide, etc. as required. The cing circuits are the real heart computer. It is this part of chine which governs the auto- operation and so to speak " the rest of the computer.

e a problem is turned over to C for solution, a mathematician reak it down into a series of steps such as additions, multi- ons, etc., which the computer ecute. The computer is told y out each of these steps (and al problem might have several nd steps many of which the ter repeats hundreds or even nds of times) by means of an tion for each step. An instruc- is essentially a code number tells the computer what to do. ample, 220005 is an instruction the computer to add (code 22) mber stored in the memory at space 0005 to the number al- in the arithmetic unit. When oblem is put on the computer, t of instructions together with essary numbers is stored in the y. Each instruction or number ed at a specified address in the y. (The word spaces in the y are all numbered and these rs are called addresses.)

r the problem is stored in the y the computer is placed in ion from the control panel by ing the address of the first in- on to be executed.

sequencing circuits send out the ary signals to cause the first tion to be read from the y. When it has been read back he memory, the sequencing cir- interpret it and send out the ary signals to the arithmetic l circuits to cause them to exe- the instruction. After the in- ion has been carried out, the netic control circuits send a sig- ack to the sequencing circuits. the sequencing circuits receive ignal they automatically cause ext instruction to be read back the memory, interpret it, and the proper section of the arith- control to carry it out. This continues at a rate up to 100 tions per second until an in- ion to stop is reached, or until ror which causes the computer p is made. The computer is so that it automatically detects of the errors which it occasion- akes and automatically corrects of them. If the computer can- rrect its error by repeating the tation it stops and signals the tor by means of an alarm bell. perator then corrects the trouble estarts the computer. —30—

AN ELECTRONIC METRONOME



By **LEON A. WORTMAN**

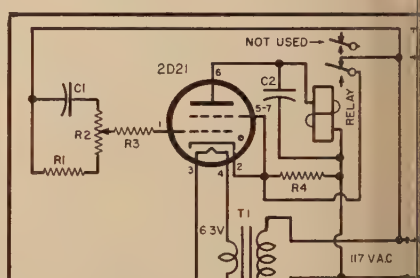
A simple instrument with an adjustable rate. The noise of relay closing marks beats.

IF YOU haven't raided the "junk box" yet for the fun of building an electronic metronome, here's a circuit that's quick, foolproof, and easy. If your daughter, son, niece, or nephew is at the piano-lesson stage, here's a metronic device (electronic metronome) that the teacher will approve. If you're a storekeeper with space for animated displays, this same device will provide automatic "stop-go" control for lights, motors, and solenoids.

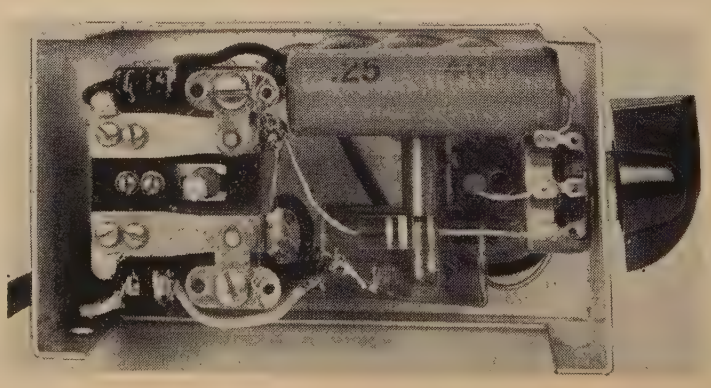
The circuit uses a 2D21 thyratron tube as the gating control for the heavy duty relay. Action time for the gating control is determined by the values of R_1, R_2, and C_1. Variation in the timing is afforded by making R_1 or R_2 or C_1 variable. Of course, it's not practical to make a .25 μfd. condenser variable. It is very simple, however, to make R_1 or R_2 the variable element. A wider range of time control is available by making R_2, the larger of the two values, the variable. A standard carbon-type potentiometer is ideal for the purpose. The acoustic sound made by the mechanical and instantaneous action of the relay creates the sound of the meter of the tempo. R_3 serves as a grid current limiting resistor. It can be eliminated but would shorten the life of the 2D21. C_2 eliminates relay chatter and contributes to smooth positive relay action. The simplest method of calibration is to beat the acoustic sound against a mechanical metronome.

For use as an animated displ "stop-go" control, the spare set of s.p.d contacts on the relay can be wired series with the electric motor, ligh or solenoid of the display.

The size of the box in which t unit is constructed has no bearing the performance. However, the sm number of components and their sm sizes enables compact construction a a more attractive appearance. The a thor's unit is built in a 2¼ x 2¼ x inch aluminum box.



R_1—330,000 ohm, ½ w. res. (IRC type BTS)
R_2—1.5 megohm linear-taper pot (IRC type PQ)
R_3—1000 ohm, ½ w. res. (IRC type BTS)
R_4—5000 ohm, 10 w. res.
C_1—.25 μfd., 400 v. tubular cond. (Sangamo type 30)
C_2—2 μfd., 450 v. elec. cond. (C-D type B 245)
T_1—Fil. trans. 6.3 v. @ 1 amp. (Thordarson T21F08 or equiv.)
Relay—Heavy-duty relay, 5000 ohm coil, 117 volts d.c. (Allied Control Co., Inc.)
1—2D21 thyratron



Circuit diagra of the home-mc metronome. 2D21 thyratro used as a gat control for rel

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Under chas view of unit. L housed in a 2 x 2¼" x 4" minum cabi

TV Tube Substitutions

(*Continued from page 50*)

...g out the rivets other parts ... be damaged, the rivets may be ...essible, etc. In those instances ... possible to wire the new socket ... into the old one by filling the ...ples of the old socket with solder ...connecting the new socket with ... lengths of bus bar. To avoid ...s, cover the bus bar with insu... sleeving.

...e of the things to watch when ...ituting tubes is the heater ...r required. In most TV sets us... 6.3 volt heater tubes, the extra ...r needed by a substitute can usu... be supplied by the transformer ...but substantially lowering the ...er voltage. Where a series heat... string is used, a substitute tube ...ring more heater current or ...er voltage cannot be connected. If the substitute takes less current, a shunting resistor must be added.

Many of the 6.3 volt tubes used in TV receivers have 12 volt equivalents such as the 6AU6, 6AT6, etc. and their 12AU6, 12AT6, etc. brothers. Since these tubes are identical in all but the heater voltage and current, the 12-volt types are not listed here. There is little chance of substituting, for example, a 12SN7 for a 6SN7. On the other hand, a 6AT6 can be substituted for a 6AV6, similarly a 12AT6 can be used in place of a 12AV6. The series heater equivalents for other TV tubes, such as the 19BG6 for the 6BG6 etc., are also omitted for the same reasons. The 6-volt equivalents may be used for 12-volt tubes which have center-tapped heaters (12AU7, 12AX7) paralleled across 6.3-volts.

Keep this tube substitution list on hand to use as a quick reference when a particular tube type is out of stock and also to show to the customer what substitutions can be made. –30–

TVI COMMITTE

AN OUTSTANDING example of a pu lic service being rendered by an am teur radio group is the Washington Te vision Interference Committee (WTVI operating in and around Washingto D. C.

The committee was formed in Ap 1952 to combat television interferen Representatives from each of seven act amateur radio clubs in metropoli Washington, D. C. were organized i one coordinated committee of techni and public relations experts.

In order for the program to oper most effectively and on a mutual sistance, cooperative basis with other ganizations interested in communi tions problems, the committee mainta close liaison with associate agencies su as RETMA, NAB, Electric Institute Washington, Telecasting Services, FC MARS, and the power companies.

The prime purpose and function this public-spirited committee is to p vide diagnostic and technical assista for amateurs involved in television int ference problems and, at the same tim to develop and maintain good neighb hood relations between amateurs a television set owners.

The ultimate success of the commit plan will depend, to a great extent, u the degree of support and cooperat extended by manufacturers of televisi receivers and their service technicia in applying corrective measures to ceivers which respond to signals outs of the television band.

WTVIC has striven to create first atmosphere of continuing mutual derstanding and interest between amateur and service technician and s ond, to promote an acceptable "edu tional" program for TV technicians developing the most effective and e cient approach to the solution of TVI problem in general.

In line with this thinking the co mittee has issued a poster and a pam let for distribution among service sh and their personnel in the Greater Wa ington area.

The pamphlet, prepared in coope tion with RETMA, outlines the proble explains the amateur's role in TVI co plaints, the use of filters, and soli the cooperation of manufacturers handling the problem.

The poster, entitled "Television In ference Aids," has been prepared WTVIC, RETMA, and the FCC. It is ing published and distributed as a p lic service by the Electric Institute Washington. The poster lists causes, effects and solutions and give circuit diagram for a high-pass filter a 300-ohm receiver input, a chart of oscillator settings for 20-30 mc. and 50 mc., as well as other service tips value to the technician.

Widespread distribution of these p ers plus the many favorable reports the committee's work have done m to alleviate TVI problems and their c sequences in the Greater Washing ara.

Chairman of the WTVIC is M Loria, W3IZL, 5131 70th Place, La over Hills, Maryland. Other amat groups interested in setting up a simi committee should contact Mr. Loria further details.

egenerative Receiver

(Continued from page 77)

er shaft and the dial serves portant purposes: to compen- r any small mechanical mis- nt, and to prevent stresses ap- the dial or panel from being tted directly to the condenser tuning it. Insulating washers uired in mounting the phone nce neither side is grounded.

coil diagram shows the details construction. The broadcast- oil is made from a broadcast an- oil (*J. W. Miller Co.* No. 20-A) ing the tickler coil (wound on cardboard tube). The assem- is attached to an old octal tube aving all eight pins, using small e screws and the mounting t that was on the coil. The acturer's markings were re- for both the primary and the oils; that is, the terminal for d connection was grounded and ound connection fed to the grid, The builder will find that the y is wound on its own short which slides over the grid coil. is intended to be cemented in sition desired by the user. For ceiver, it should be cemented in with its center ⅜" from the (terminal or lug end) of the oil. The tickler is wound with ns of No. 28 enameled wire on n made of a piece of cardboard of large enough inside diameter tightly over the very end of the ast coil form (1 1/16"). Some nd trouble in finding the right- orm can be saved by purchasing issner No. 14-6852 "slip-over ry," which costs twenty-five stripping the original winding it, and using this as the tickler Wind the tickler and cement the together so that the tickler and windings are about ⅛" apart. plugging in or removing the eted assembly, the fingers should he base.

short-wave coils were wound iller No. 74002 coil forms with 8 enameled magnet wire. The ion of winding was the same for of the three coil elements, pri- grid, and tickler. Small holes drilled in the spacers to provide rs for the coil ends during wind- It is best to coat each coil ele- with polystrene coil dope after ng it and before winding the element of the coil. If any ad- ent of the coil is required, it probably be on the tickler, which und last. This part can be doped

er the wiring is checked and the ries connected, it is a good plan easure the voltage between pins d 8 of each tube, or to test with all flashlight bulb before insert- he tubes. If any voltage other 1.5 volts were placed on the ents as a result of incorrect wir-

ing, the tubes would, of course, burn out instantly.

The standard parts lists that go with circuit diagrams in the usual construction article show only electrical parts, so to save the beginning student some trouble in selecting mechanical accessories they will be mentioned here. The front-view photograph shows a vernier dial; either of the *National* types B or BM would be suitable. A standard phone plug should be purchased for the headphones, as they will come with phone tips, now seldom used. The front-panel jack for them should be of the open-circuit type. Three tube sockets will be needed, two loctal and one octal. The open-ended chassis is a *Bud* CB-41. The flexible coupling for the condenser shaft is a *National* TX-22. Similar units of other makes may be used. The purchase of a spool of #28 enameled wire and of a bottle of polystyrene coil cement or "dope" was implied earlier. Use rosin-core "radio" solder; do not use acid-core solder or soldering flux in this application. Even slight corrosion in a radio joint can ruin the performance of the equipment.

Operation

The detector is put into oscillation by turning the regeneration control in the direction of increasing capacitance. The appearance of oscillation is marked by a soft hiss if the control is turned slowly, or a click if it is turned more rapidly. Tune for weak signals with the set just oscillating until a signal is heard, and then "back off" the regeneration control. Greatest regenerative amplification is obtained at the point just before the detector starts to oscillate. Strong signals, particularly on the broadcast band, are best tuned in with the set not oscillating. The c.w. signals are received with the set oscillating, and the point of greatest sensitivity is just beyond the point where it starts to oscillate.

If the set does not oscillate properly, the wiring should be checked again, and particularly the tickler connections. A common cause of failure of a set to oscillate is reversed tickler connections. If the set does not oscillate at the low frequency end of a tuning range (condenser plates closed), the maximum available feedback is insufficient. This condition may be corrected by winding additional turns on the tickler coil. On the other hand, if oscillation cannot be stopped at the high frequency end, turns should be removed from the tickler. Sometimes oscillations may fail over a short interval in the tuning range. Such "dead spots" are due to resonance effects in the antenna and may usually be cured by inserting a small condenser, 100 $\mu\mu$fd. or less, in the antenna lead.

"Body capacity" is a common ailment of short-wave regenerative receivers when the antenna is coupled directly to the detector. This is a

...in which the operator may ... slight change in frequency or ...lation by touching the receiver ...he leads. It is caused by the ...at the operator becomes part ...antenna circuit and alters its ...al characteristics. We had ...trouble from this source above ..., but were able to eliminate ... all of it by moving the re... to a location where a short ...tion to a radiator ground could ...l. Other methods which may be ...e in individual cases are: in... a small fixed or variable con... in the antenna lead, loosen...e antenna coupling, bypassing ...none leads with a condenser ... .001 or .002 μfd.), or grounding ... separate points.

...he receiver is located too near ...ng station on the standard ...ast band, difficulty will prob...e encountered in tuning it out ...tely. Although the receiver ...high selectivity when the regen... control is advanced, a very ... signal tends to "tail off" over ...siderable portion of the dial. ...nly real remedy for this dif... would be to use more tuned cir... but then we would be dealing ... different type of receiver alto... By careful tuning to the exact ...ncy of the desired signal, the ...of the strength of the two sig...nay often be made such as to ...cally eliminate the interference. ...ocal reception, all but three or ...feet of antenna may be discon... and still leave enough sensi...for good results. Various wave... circuits may also be used.

...ittle skill is required to tune a ...erative set properly, but an eve... or so of patient effort will re... the constructor with many hours ...joyable listening. —30—

Transistor Timer

(*Continued from page* 69)

...or a specific short interval (as ... warming solutions). Where a ...ng element or other piece of ...ment requiring large current is ... care must be taken that the ...mum current rating of the relay ...cts is not exceeded.

...ll another application is in con... a tape machine or record ...r so that a specific commercial ...age may be delivered when the ...et" button is pressed. A typical ...ple would be in the display room ... convention or show. When a ...erby presses the button, a tape ...back machine operates for a spe... period of time, giving any desired ...age or "sales talk."

...similar application is in the oper... of mechanical displays.

...e reader can undoubtedly list ...y other possible applications of ...imer. Then, too, once the builder ...had a chance to experiment with ...completed unit, other possibilities ...occur to him. —30—

DRUGSTORE COIL FORMS

By WM. BRUCE CAMERON, W8IVJ

AN EXCELLENT coil form for many purposes may be found at most drugstores in the form of a small plastic vial, used for pills, capsules, etc. These come in a variety of diameters and lengths, are hard transparent plastic, fitted with flexible plastic caps.

They appear to be good r. f. material, judging from the ones I use in my grid dipper and v. h. f. gear. For receiver and transmitter use, the caps may be fastened to the chassis with a machine screw, and the pre-wound coils slipped in and out easily. These are excellent for grid-dippers, since the flexible caps can be fitted with banana plugs and will take rough handling without breaking.

Since the forms are transparent, data on the coils, such as frequency range, can be typed on a slip of paper and inserted in the forms before sealing, giving them a truly professional appearance. Caps and vials may be permanently joined with "Duco" or similar cements. Prices will vary with size and with the druggist, but will run around fifteen cents—less than many commercial forms. —30—

LINCOLN TUNNEL TRAFFI CONTROL

Traffic snarls are rare an relatively painless thank to "Message-Repeater" unit

A TINY cartridge, smaller than a man's hand, is playing an important role in meeting emergencies in the Lincoln Tunnel, linking Manhattan and New Jersey.

Since January 1952, the south tube of the tunnel has been equipped with a radio transmitter. As motorists enter the tube from Weehawken, N. J., they pass under a large sign which reads, "Lincoln Tunnel Radio—500 on Your Dial." By tuning in that frequency they receive music and messages to make the under-river trip faster and more pleasant.

Between musical selections, the tunnel radio advises drivers to relax in their cars if they should have a breakdown or a flat because the Port Authority will move the car safely and quickly without charge.

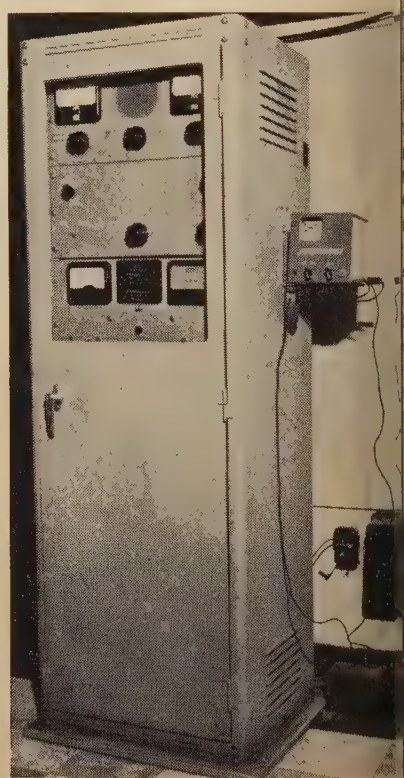
In cases of emergency, a special cartridge is inserted in the "Message-Repeater" alongside the transmitter and the appropriate warning is transmitted to the drivers. Each cartridge bears a pre-recorded message prepared by a professional announcer to meet varying situations. Utilizing the canned message frees one tunnel officer from the task of making vocal announcements when anything g wrong. If anything occurs which is covered by a prepared tape, the t nel officer in charge can speak i the "Message-Repeater" through hand microphone and instantly rec a message to meet the new conditio

Officers at the control tower in tunnel are enthusiastic over the s cess of the operation. They are h ing that funds will soon be availa to provide a similar setup for third tube which is now under c struction and they would like to the system extended to the highw which feed the tunnel. As one offi explained, "When the cars get h there isn't much we can do exc explain the reasons for the tie-up, if the radio were extended to highways we would and could ch nel traffic to other of the cross-ri routes when we're tied up."

The tunnel radio system was veloped and installed by *Touradio* of 25 Vanderbilt Ave., New York, N and the "Message-Repeater" unit i product of the *Mohawk Business M chines Corp.* of 47 West Street, N York, N. Y.

—30—

The master control unit of the Lincoln Tunnel radio system with the "Message-Repeater" unit at right. Pre-recorded messages can be transmitted at will.



Sgt. J. Knight of the N. Y. Bridge and Tunnel Authority inserts a cartridge containing a pre-recorded message in repeater. Message is on endless tape.

Electronic Shipyard

(continued from page 57)

...rage according to the space oc-...oy equipment.

...d arrange to work on boats in ...rather than as single "strays" ...d there, so travel costs can be ...d In removing equipment, mark ...e cables to prevent accidental ...rcuit.

...r-boat antennas should be taken ...any joints greased, and any ...eft in the deck or bulkheads ... Leaving an antenna up in ...amage. Yard workmen have ...nown to break the antenna off ...o squeeze a boat through a low ...y, or to tear it out by the roots ... an obstruction.

...moment any equipment is taken ...shop increase your insurance to ...because, although most boats ...marine insurance covering all ...e, you need protection in case ... for contingent liability by the ... underwriter. The cost can be ...ed among the boats so served. ...put tag, with a number, and a ...or a description of the work to ...e, and a parts and time record ... be put on the panel of each in...nt, and the same number ...d on every piece, such as the ...t, cabinet, and remote control. ... set should be put on the bench ...ecked for operation, a prelimi...est to find out early if the set ...me serious fault which might ...harts from the factory to cor...Early in the winter is the time ...e care of these troubles—not ...boats start slipping down the ...in the spring. Do not bother ...ny alignment or other adjust... of the "final" type. Too much ...ppen between now and commis...g time.

...dr this check the chassis can be ...out, brushed and vacuumed, a ... of silicone put on switch con...and any corrosion removed. Ker... applied with a toothbrush, has ...round to be about as effective as ...ng for this job.

...finets that are not too badly cor...can be spotted, after bad spots ...noothed and the old paint "feath...with sandpaper. A dull touch-up ...r is best, or it may be possible ... an air-drying mix from the set ...facturer that will blend. Chromed ...can be sent out for re-chroming. ... handset cords should be re..., and operation tested, as they ...e rough treatment.

...v is also the time to take care of ...ments, such as having engraved ... many owners want put on their ...one panels giving the boat name ...call letters, or modifying the ...ment for external speakers, the ...g of "bull horns" on deck, or ...ding for remote controls. The ...es are that some of these things ...be thought of by the owner the ...time he takes the boat out—it is

better to think of them now when the work can conveniently and unhurriedly be done.

Well in advance of spring drag out all of the sets. Group them according to kind and use a check list for the operations. Check all tubes. Very few will be found low, but remember that marine radio is an emergency service, and the best place to catch incipient failures is on the shop bench. Another thing this will do is scrape corrosion off the tube pins and socket terminals. For this reason, also wiggle the crystals and the vibrator, even though it has a nice steady hum.

Align the receiver and check sensitivity with a signal generator. For sets not having crystal-controlled receiver oscillators use a "live" signal or an accurate frequency meter to line up the front end.

Measure the transmitter frequency on each channel. The FCC regulations call for the official measurement to be made with the equipment on board the boat—but a preliminary check is justified because if a critical condenser has spilled its microfarads it can more easily be replaced in the shop than out in the bay.

Transmitter power-amplifier tuning should be checked with no load. A milliammeter or voltmeter jack is provided, and, if necessary, the final tank should be readjusted for minimum plate current. The transmitter coils should be carefully inspected for short-circuited turns, and any clips close enough to touch should be wrapped with plastic insulating tape. Clips should be tightened, as required.

Last, a dummy antenna should be connected, and the power output and modulation tested. Power is measured using a variable condenser and non-inductive 34-ohm load, and an r.f. ammeter in series from the transmitter antenna post to ground.

Modulation may be measured with instruments built specifically for the purpose, or an oscilloscope. If these are not on hand observe antenna-current rise under full modulation. If there is no carrier shift a 22% increase is indicative of 100% modulation, while a 10% increase indicates about 65% modulation. The signal should also be monitored on a receiver to detect any hum, distortion, or other objectionable characteristics. During modulation measurements, amplifier-plate current should be watched to make sure it does not fluctuate more than a few per-cent, which would be indicative of excitation shortage, parasitics, or overcoupling.

In the spring, re-installation will simply amount to putting the gear aboard, connecting up, and final check.

Work to be done should be strictly understood with the owner, and bills should be itemized in full. This became apparent to me after one nearly-painful experience.

The owner had said, very off-handedly, that when his radiotelephone was stored all of the garish (to him) brass on the panel should be removed,

and chrome-plated, so the tele- would better match the decor of in. This sort of request is com- o the girl in my office jotted he order without comment.

telephone happened to have ole works fastened to the panel etting the brass separated re- turning the set into a fright- octopus of sockets, cables, and ng parts—strictly a basket case. the thing was finally put back er, resplendent in its new e front, the boatman was pre- the bill: $93. He sailed off on se and didn't show up the rest summer.

n he returned we had the bill down so it was apparent that taken so many hours to pull the art, so much was charged by ater, and then it took so many hours to put the parts back to- . Although the total still came he could now understand why, e paid without a whimper.

rt now to get some of this win- rk lined up. Hardly a boatman need reminding that if they keep you alive during the off- you'll be around, better than when they need you next spring.

TOR'S NOTE: *All transmitter ad- ents as described in this article be made by the holder of a com- al radiotelephone second-class igher) operator's license. Any e shop contemplating entering arine servicing field should see someone in the organization has es out this license. The exami- contains no code elements and hin the technical capabilities of petent service technician.* —30—

"Subscriber-Vision"

(*Continued from page* 59)

ular week. The proper button s the correct combination to be for the particular program. The t sweep signals are then fed to orizontal output stage and ap- to the horizontal deflection coil. sound signal goes through the i.f. stages and is then detected e normal manner. However, the t of the detector will be a scram- amplitude-modulated signal. In to clear it up, the process at ansmitter is reversed. The signal into a frequency remodulator might actually be considered as nd detector. Also going into this ency remodulator is a signal the "Decoder" unit. With the t decoding signal, the unscram- sound is then fed to the audio fier and then to the speaker.

should be emphasized that this n, like other subscription plans ntly being introduced, is still to proved by the Federal Communi- s Commission before anything than test transmissions are per- d. When such action will be is anyone's guess. —30—

Mac's Service Shop

(*Continued from page 86*)

moved the defective unit and replaced it with a new transformer, but when he turned on the receiver it gave out with very poor quality and produced an audio howl at certain settings of the volume control. No checking of filter or audio bypass condensers turned up anything wrong, nor could any of the normal causes of audio amplifier instability be discovered.

"I should have stood in bed," Barney said with a sigh. "And this was the day I thought was going to be an easy one! I can't pick a set that has one nice simple little thing wrong with it like an open transformer. Oh no! I've got to draw one with complications."

"Maybe it didn't have complications until you replaced the transformer," Mac suggested.

"What do you mean by that crack?" Barney demanded truculently. "Are you insinuating I can't even replace an output transformer without making a mistake?"

"Could be," Mac said with a shrug as he picked up the speaker with the new transformer mounted on its frame. "What's this wire going from one side of the voice coil to the speaker plug?"

"I didn't trace it out, but I guessed it went to a terminal on the chassis for connecting an output meter across the voice coil," Barney replied. "Lots of sets use that, you know."

"But does *this* one?" Mac insisted as he pointed at the service manual shelf.

Reluctantly Barney hauled down the service manual and studied the diagram. "It doesn't go to a terminal," he said slowly. "Instead it seems to go back to the input of the first audio tube."

While the boy had been looking at the diagram, Mac had picked up the solder gun and had reversed the lead coming from the output transformer secondary, leaving all the rest of the connections intact.

Then he turned on the set, and the tone quality was excellent. No sign of amplifier instability could be found at any setting of the volume control.

"Since when has a guy got to observe polarity in output transformer secondary leads?" Barney demanded. "If that's necessary, why don't they color-code them?"

"Ninety-nine times out of a hundred it's not necessary," Mac explained, "but this is the hundredth time. This set uses negative feedback, and the feedback tap is taken from one side of the voice coil. There is, of course, a 180 degree phase shift from one end of the voice coil to the other. When you replaced the transformer you happened to solder the tap to the wrong side of the voice coil and it started feeding back voltage that was "positive" rather than "negative

f course, accounted for the ality and the tendency to oscil- Vhen the leads from the trans- were reversed, all was well. had just looked at the diagram peginning to make sure of the of that lead from the voice u could have figured all this yourself."

sure a prize dope," Barney ad- "As many times as you have , it looks like I would learn to e manuals. I've always been at, though. When I'm look- something in a catalogue, I se the index as a last resort, ough I know I can find what I uch quicker by using it. I kind like I've been licked if I have the index.

the same way with the manu- guess I'm trying to prove how I am by showing that I can get without them. What I end up , as I've just shown, is how am."

't be too hard on yourself," Mac d. "A mistake that's recognized corrected, and I'll make a l-thumber out of you yet—I —30—

Brightness Control

Continued from page 81)

grid produce corresponding es, amplified and shifted in at the plate and on the pic- ube cathode. The brightness is adjusted so that, during the ng pulses, the picture tube e is sufficiently positive with t to the grid and the first anode nk out the screen. If the signal ude decreases by half, the pic- ube cathode might become 20 ess positive during the blank- lses, but only about 3 volts less e during the brightest parts of cture. The retrace lines would ible, but the white level would changed much. Video ampli- rect coupling is not, by itself, nole answer to the problem of atic brightness control. It does alf the job, keeping the white approximately constant; the half, keeping the black level nt, requires a.g.c. in the re-

o amplifier direct coupling does two advantages over the other ds mentioned. Its white level tion is instantaneous, since it ot depend upon condenser charg- discharging, while its black regulation is as rapid as the re- s a.g.c. system. If the maxi- brightness changes from scene to the change is reproduced, as, with direct white clamping, scene has the same maximum ness. Many manufacturers, such *niral, Arvin, Bendix, Fada, Gen- Electric, Hoffman, RCA Victor, n, Sylvania,* and *Westinghouse,* used or are using direct-coupled amplifiers. —30—

INEXPENSIVE ENCLOSURE

By J. WESLEY SWAUGER

WHEN I saw the specifications for the E-W speaker enclosure in the July, 1953 issue of RADIO & TELEVISION NEWS, I became enthusiastic about building one. Since the budget wouldn't stand the cost of the prescribed materials, I decided to attempt to construct it with ordinary corrugated pasteboard.

I first made a box of the right size and then proceeded to build it up by gluing on layer after layer of pasteboard. I staggered the overlaps for added strength and applied new layers until it was five layers thick. Then I glued in the baffle plates and the partition.

My enclosure actually consists of two boxes: the one which contains the baffles and has no front slides inside the one on which the speaker is mounted and which has no back. This was necessary to provide a means of speaker installation.

The results are most gratifying. Although a plywood model would undoubtedly be superior, my eight-inch speaker gives better low-frequency response in this enclosure than it has ever given in any other baffle. It took a long time to complete the project because I had to let the glue on each piece dry for twelve hours, but the total cash outlay (for glue) was only seventy-five cents!

If you want an inexpensive enclosure that is fun to build and easy on the pocketbook, this is it. —30—

NEW APPROACH TO TV SERVICE

By **CARROLL W. HOSHOUR**
Director of Sales Engineering
TV & Radio Div., Raytheon Manufacturing Company

A consumer guide and factory manual allow the servi technician to do half the job before leaving the sho

THE American TV-owning public has come to realize that no matter how well designed, engineered, and manufactured a TV set may be, sometime during the first year or two it will require service. This service may involve anything from component parts or tube replacement to something as relatively minor as a back apron control adjustment.

Any plan that makes such servicing faster and better is of benefit not only to the TV set owner, but to the service technician and the TV manufacturer as well. Among TV manufacturers there are those who believe that to admit that their sets will require service is "negative selling" and will cut down on their sales. The *Raytheon Manufacturing Company,* on the other hand, believing that a planned program or device that would assist both the consumer and the service technician toward a fast, efficient, and economical solution to their service problems would be of benefit to all concerned, has introduced the "Service Saver" to the TV industry.

The term "Service Saver" is used for the program since its prime function is to save time, save nuisance service calls, and, in turn, save money.

Primarily, the "Service Saver" makes possible the transfer of factual information from the customer to the service technician. Today, when Mrs. Jones calls for TV service and complains of black wavy lines in her picture, the service technician has to take a wild guess as to whether it is r.f. interference, sound bars, poor horizontal hold, or a.f.c. trouble. It is quite obvious that if he could see the condition that Mrs. Jones is attempting to explain, he could, in the great majority of cases, come completely equipped with proper tubes or components that would effect a speedy remedy.

Raytheon has shown in their "How to Interpret What You See" lectures to service technicians across the nation (see RADIO & TELEVISION NEWS, April, May, and June, 1952) that approximately 90 to 95 per-cent of the troubles which occur in TV receivers appear as visible defects on the face of the picture tube. The service technician who has learned to interpret from the face of the picture tube the various circuits of a TV rec contribute in the average picture in turn, recognize what circuit fa is responsible when a bad pictu produced.

Some service dealers use ap tices or trainees on preliminary saving the more skilled technicia bench work or special calls. Wi accurate description of the tr from the customer, the skilled te cian can explain to the apprenti actly what tubes, adjustments, c cuits should be checked.

The "Service Saver" consists o units. One, a TV owner's guid companies each new *Raytheon* T ceiver. This booklet contains 4 tures of different defects shown c face of a TV picture tube and c approximately 95 per-cent of the bles that can be caused by misa ment, tube, or component failure. picture is numbered and corres to a specific defect. Arrows a word of explanation are used to cate movement of the picture terference effect. These pictures produced by a flying spot scanner ing a black shaded map of the U States feeding into a TV chass addition to the pictures, letter used to denote five different conditions that further assist the nician. Thus, for example, "A" de normal sound, "B" no sound, an hum or buzz in sound.

The second unit is the factory ice manual which is available service technicians. This manua tains a section in which the num pictures in the owner's guide a produced. However, here, each bered condition is described in with a sectional schematic co the particular circuit responsib parts list, a layout drawing c chassis showing the position c parts in question, and a sug procedure for remedying the con

Upon original installation of t ceiver, the customer is told t trouble should occur, she (o should compare the picture o face of the CRT with the 40 pi in the guide. She then report number corresponding to her p and the letter corresponding t

to the service technician (or aking the call at the service). The service technician then uses his service manual to cor- the picture with the defect. a test of a group of average vives who were asked to identify ferent conditions on a TV re- using the "Service Saver," over -cent of the answers were cor-

n the "Service Saver" consumer and the service manual are avail- o all TV service technicians from *aytheon* Receiving Tube Division.

—30—

F. SUPPLY FOR SCOPES

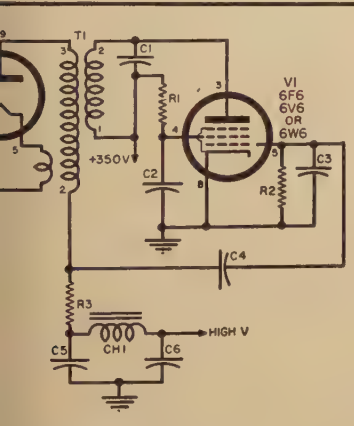
By HOWARD ZIMMERMAN

ONVERTED one of our scopes to power supply some time ago, and to considerable difficulty adapting be transformers to this application. ried several different makes and of coils before finding one which give us the desired results without se of extensive modifications or ircuitry.

circuit shown here is the one we settled on. Standard parts are hroughout, and the bleeder circuit scope does not have to be changed her value resistors due to the re- power developed by the oscillator. wo terminals of the transformer, "#2," were tied together on the al unit and must be separated to a negative voltage supply.

e voltage output of the circuit can ried over a considerable range by ion of different oscillator tubes. tubes with the voltages we ob- from them are given in the parts The amount of output, therefore, endent upon the tube selected, e.g., 6F6 the output is 1750 volts, with it is 2100, and with a 6W6 the t voltage becomes 2700 volts.—30—

e power supply circuit for a scope.



0,000 ohm, 1 w. res.
00,000 ohm, ½ w. res.
00,000 ohm, 1 w. res.
003 µfd. mica cond.
05 µfd., 600 v. cond.
—50 µµfd., 1000 v. cond.
—.002 µfd., 2500 v. cond. (use 5000 v. h 6W6)
5.5 kv. r.f. high voltage trans. (Stanwyck be 960)
–10 mhy. choke
5F6, 6V6, or 6W6 tube (High-voltage put 1750, 2100, and 2700 volts respec- ly)
V2 tube

Intermittent Checker

(*Continued from page 56*)

the output stage. The other lines were placed at the screen of the output stage and at the cathode of the damper. After a period of about 50 minutes, the buzzer sounded and lamp #2 (monitoring the screen circuit) lighted. This indicated that the trouble was in the screen of the horizontal output stage. The trouble could not be in any of the previous stages, otherwise the grid lamp would have gone on. Checking the components in the screen circuit, it was noted that a 6800-ohm resistor had a resistance of 10,000 ohms. This resistor was checked about five minutes after the set was allowed to cool and, consequently, it may be assumed that it had an even higher resistance when the transient occurred. Replacing the resistor, which apparently was increasing in value as the temperature increased, remedied the trouble.

In another set, the video and audio disappeared and re-appeared intermittently but the raster remained. The trouble was therefore in common circuits; *i.e.*, r.f., i.f., or video. T set used a *Capehart* CX-37 chas The three lines were connected follows: #1 at the output of the vi detector; #2 on the "B+" to tuner, since previous experience w this set indicated that the bleeder sistor frequently opened; and #3 the output of the video amplif After about 15 minutes, the buz sounded and lamp #1 lighted. T indicated that the trouble was eit in the video i.f. amplifiers or video tector. With #1 left at the sa point, #2 was placed at the 3rd vi i.f. plate, and #3 at the 2nd video amplifier. After about 20 minutes, buzzer sounded and lamp #3 light indicating trouble in either the 2nd 1st i.f. Examining the plate circuit the 2nd i.f., however, showed that connection to the i.f. transformer w corroded. The connection was moved and resoldered, and the tr ble was remedied.

These two examples should serve illustrate the wide field of applicati in TV service work of the intermitt recorder. No longer need interm tents be the bugaboo of the serv shop. This instrument should help reduce callbacks appreciably. —

TRANSISTOR "WIRELESS MIKE"

By A. H. HELLMERS

AN ENTERTAINING gadget of durable popularity is the "wireless mike," a voice-modulated r.f. oscillator which can be picked up in a standard broadcast receiver at distances up to 20 or 30 feet. In common with "wireless" phonograph oscillators and the radio remote-tuning devices sold some years back, these units are not transmitters in the FCC sense of the term as long as their range is small compared to the wavelength at the operating frequency.

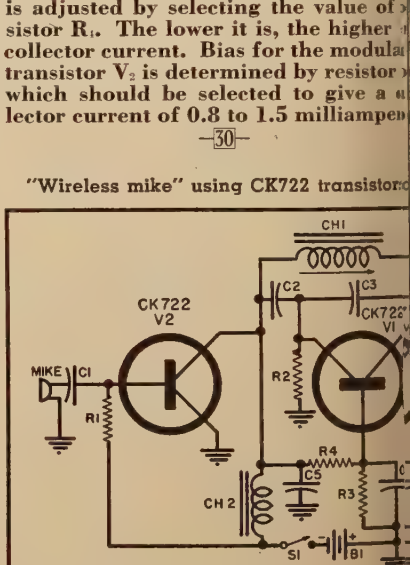
The transistor circuit shown operates in the low-frequency half of the broadcast band, where the wavelength is upwards of 900 feet. V_1 is the r.f. oscillator. The Colpitts-type circuit is tuned by means of a powdered-iron slug to an empty spot in the broadcast band, somewhere in the vicinity of 700 kc. This oscillator is "plate" modulated in the regular Heising style by a second transistor V_2. The microphone was a balanced-armature magnetic unit having a d.c. resistance of 200 ohms, obtained from a surplus collection. Since the input impedance of V_2 is on the order of 1000 ohms, a low-impedance mike is required. Crystal microphones will not work.

It was found that the tank capacitances in the r.f. oscillator circuit shown must be small, or the circuit will not oscillate at frequencies as high as the lower edge of the broadcast band. Hence an inductance somewhat larger than the usual broadcast coil (0.3 millihenry) is needed. The one used here is a commercial surplus item. However, it should be effective to rewind a broadcast-band coil to about twice the original number of turns. Experimentation is easy because no tap is required, and the "Q" need not be particularly high. In the present state of the transistor art there is, of course, no assurance that all individual transistors of any particular type will have the same upper frequency limit of oscillation. Broadcast band frequencies are definitely at the high limit, for junction transistors, apparently, and that can be said is that two transis worked in this circuit.

The battery drain for the oscilla should be between 0.4 milliampere a 1 milliampere. Before operating the cuit, this must be checked. Proper will vary with different transistors. is adjusted by selecting the value of sistor R_1. The lower it is, the higher collector current. Bias for the modula transistor V_2 is determined by resistor which should be selected to give a lector current of 0.8 to 1.5 milliampe

—30—

"Wireless mike" using CK722 transistor



R_1—51,000 ohm, ½ w. res. (see text)
R_2, R_3—10,000 ohm, ½ w. res.
R_4—22,000 ohm, ½ w. res. (see text)
C_1—.5 μfd., 100 v. cond.
C_2, C_3—27 μμfd., mica cond.
C_4—.01 μfd., 100 v. cond.
C_5—.005 μfd., 100 v. cond.
CH_1—.5 to 1 mhy. variable slug-tuned coil
CH_2—10 hy. choke
S_1—S.p.s.t. switch
B_1—7½ volt battery
Mike—Variable reluctance mike or sound-po ered telephone unit (see text)
V_1, V_2—CK722 junction-type "p-n-p" transi tor (Raytheon)

rtified Record Revue

ontinued from page 70)

bass, it is more than offset sheer beauty of this great Vith NARTB equalization, a boost in bass and treble was y. Surfaces were quiet. Cer- ot a hi-fi demonstration rec- a very thrilling piece of ell worth your time.

OS

VE SPANISH DANCES

haniz, pianist. Westminster , 33⅓ rpm, NARTB curve. 95.

dos was a master of his nstrument, the piano. In his that fact is very clearly re- These twelve pieces are not Spanish folk tunes embroidered bellished by a master crafts- These are the very essence of musical idiom, a penetrating y personal utterance of a man ew and loved his country. Mr. z has a big, solid tone and the l proficiency to cope with the ities of the score. Rhythm is ntial basis of this music and the right at home with the color- rations which give this music cally Spanish character. The ecording is sharp, close to, gen- ood. There is occasional thin- tone and some noticeable flut- these are minor faults. Repro- was satisfactory with NARTB tion and bass and treble set flat. Surfaces were a lit- y in my copy. Really enjoyable eces, but I would advise against of all twelve of them at one hey can get a little repetitious. eresting note is the way in Granados died. Most composers y don't meet their end in this he went down with the Eng- amship "Essex," when it was ed by a German sub in 1916!

NBERG

RVIVOR FROM WARSAW, SEC- CHAMBER SYMPHONY, and NIDRE

Symphony Orchestra and Aca- Chamber Chorus conducted by warowsky and Herbert Hafner. a ML 4664, 33⅓ rpm, Colum- e. Price $5.45.

interesting works by Schoen- igh priest" of the twelve-tone of music. "Survivor from War- or speaker, male chorus, and ra, is a cantata about a death of some victims of the Nazis. d by one who escaped the the work is somewhat obvious ropagandizing, but nevertheless verfully written and grim lit- of horror. The "Second Cham- nphony" is for Schoenberg, a rical piece and not character- much of his atonal devices ects. Recording is good if un- even in the three works and surfaces were quiet. The LP curve reproduces it quite nicely without any touch up. An off-beat item you might like.

BRITTEN

VARIATIONS ON A THEME BY BRIDGES

WARLOCK

CAPRIOL SUITE

Boyd Neel String Orchestra conducted by Boyd Neel. London ffrr LL801, 33⅓ rpm, NARTB curve. Price $5.95.

Here is some more of the special Coronation releases of music by British composers. The Britten piece is by far the better of the two. The "Capriol Suite" is well recorded, but the performance leaves something to be desired. The "Frank Bridges Variations" is a vigorous work, though somewhat rough-hewn. The string tone has none of the "steeliness" some people complain about from London. Rather, the strings are rich and clean, with just enough edge to give them presence. Oddly enough, instead of the usual roll-off necessary in the bass end of London records, with equalization set at NARTB this one needed a little boost. This kind of music is Boyd Neel's particular dish and he makes the most of it. Except for occasional raggedness, the string playing is outstanding and Mr. Neel elicits some wonderful sound from his well disciplined group.

BARTOK
SONATA FOR TWO PIANOS AND PERCUSSION
GOEB
SYMPHONY NO. 3
Leopold Stokowski and his orchestra. Gerson Yessin and Raymond Viola, pianists; Elayne Jones and Alfred Howard, percussion. RCA Victor LM1727, 33⅓ rpm. RCA Orthophonic curve. Price $5.72.

Well, I wish I could report to you that we have a real bang-up new version of the Bartok, but such is not the case. Oh, all the elements needed to make this a success are there all right. Mr. Stokowski is an absolute genius when it comes to conducting the moderns, the pianists are highly proficient with a keen insight of the complex score, the percussionists precise and alert. What's wrong? The sound dear friends, the sound. This should have been a hi-fi *tour de force*. Goodness knows there is enough material in the Bartok! What with snares and pedaled tympani and side drum, tam tam, cymbals, the gran cassa, bells, triangle, etc. you ought to be able to tear the house down. Unfortunately, whatever *Victor* did with the top end of this disc, it just doesn't come off. This is doubly unfortunate, because actually this is one of *Victor's* better efforts. The pianos are properly percussive in tone, the percussion bright and clean. It is just that very top end, that little extra that adds the punch and the presence to a recording that you miss so much. I dunno, maybe I'm hearing too much of this stuff lately, and I am splitting hairs and being hypercritical. Maybe you'll think it's great. It is just lacking that little something that sends me. The Roger Goeb work has some marvelous writing in it, although its not the kind of thing you fall in love with on the first hearing. Again Mr. Stokowski is at home with the music and favors it with a powerful reading. The Orthophonic curve needed correction for bass deficiency. As with most of *Victor's* records the surfaces were very quiet. In fact I think this quietness has something to do with the top end trouble. I'm going to investigate and I'll let you know what I find out.

BACH
VARIATIONS ON SEI GEGRUSSET, JESU GUTIG, and FIVE CHORAL PRELUDES
Finn Videro, organist. Haydn Society HSL3063, 33⅓ rpm, AES curve. Price $5.95.

Finn Videro is one of the world's great organ virtuosos. His playing of these beautiful Bach pieces is a model of good taste and his registration admirably chosen. It is too bad this is such a poor recording. The work played on a magnificent old baroque organ, suffers from tape flutter, and in the inner diameters the intermodulation distortion gets pretty fierce. This is not the kind of organ recording to test out the low frequency response of your speaker system. Its a

because the playing is well

HOVEN
ATA NO. 29
Philharmonic Orchestra conduct-Felix Weingartner. Columbia 5, 33⅓ rpm, NARTB curve. 5.45.

is the famous orchestral tran-on Weingartner made from the al piano many years ago. *Colum-*as done an admirable transfer om the 78's and the recording nas benefited. Certainly not up ay's standards, it is nonetheless citing work and a good sound-sc. Good orchestral balance with ent string tone and comparative-et in spite of its 78 origin. As to er this great work is more effec-n the original piano version or ranscription is a moot point. I hem both, and since it is ex-ly difficult to come by a really performance in the piano origi-his is a welcome, if somewhat change. In transfer, the equal-n has become the standard FB and reproduces well from curve with a few db of boost in pass and treble.

L
LERO
KY-KORSAKOV
PRICIO ESPAGNOL

t Symphony Orchestra conducted ul Paray. Mercury MG50020, rpm, AES curve. Price $5.95.

s is the initial effort of the De-Symphony for the *Mercury* npian Series." To say that they heir best foot forward is to put ldly. The "Bolero" has finally of age in this recording. You sk, why another "Bolero" when are already umpteen in the LP gue? The question is valid until nalyze the existing recordings. there is no really modern re-g, and the others of fairly re-vintage were not wholly satis-y. Secondly, there has not been lly good performance of this since the old Koussevitsky read-n *Victor*. Here in this disc, 'Bolero" becomes a new and ng experience instead of the tired old warhorse. Paray is an ing fellow who knows his way d, especially with French rep-. His pace in the work is er too slow, nor does it become tic. With poise and restraint he , tower upon tower of sound the final, shattering climax. The is finally the way it should al-sound, crisp, clean and compel-insistent. The brass has good and is well played, the wood-ragged at times, but good solo throughout. The dynamic range is disc is incredible. Try this: the work through to the climax hen quickly put your pickup to eginning. You won't believe it! 'Cappricio Espagnol" is a knock This will be the hi-fi crowd's nt. Terrific brass, thundering tympani, and bass drum. Sharp, incisive strings. Clashing cymbals and gongs! All the things that are dear to the hearts of audiophiles. Paray gives the colorful work a spirited performance. His dynamic shadings are marvelously detailed and his beat sure and strong. If you want a big kick, wait till you hear the snare roll at the start of the second section. Wow!

DELIUS
BRIGG FAIR, ON HEARING THE FIRST CUCKOO IN SPRING, and OTHER SELECTIONS
London Symphony Orchestra conducted by Anthony Collins. London ffrr, 33⅓ rpm, London ffrr curve. Price $5.95.

Still another of those special Coronation releases. This is soft lovely music, typical of Delius' dreamy half-world stuff. Innocuous pieces, yet they have a certain strength and character. Collins leads his orchestra in a competent well-paced reading. Beecham is supposed to have the inside track with Delius, but I don't see how he could excel this Collins reading very much. Altogether admirable. The sound is good and clean, if unsensational. This is not for the blood and thunder boys, but rather is the quiet dreamy sort of thing that goes well in the summertime, with a glass of cold beer on the front porch. Try it for yourself. This stuff can grow on you in no time. —30—

TV Sweep Generators
(*Continued from page 46*)

izontal input terminal of the oscil scope. The saw-tooth deflection vo age which is normally used in t scope is turned off and the 60-cy sine-wave voltage from the genera is used instead to sweep the bea across the screen.

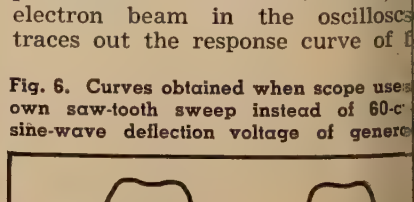
Now, why is this done? This is d because the frequencies being obtai from the sweep generator are vary back and forth across the band i sinusoidal manner. Only by combin a sinusoidally deflected scanning bea with a sinusoidal sweep frequency v iation can we obtain a response p tern in which the frequency is eve spaced. This may sound somew complicated but it boils down to th If we vary the sweep generator o put one way, then to obtain a prope shaped pattern, the beam deflection the scope should be similarly vari

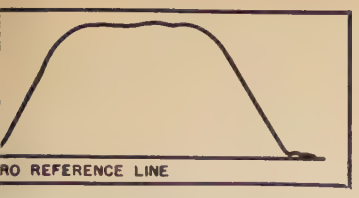
Suppose we don't do this. Suppo we forget to bring the extra 60-cy voltage from the sweep generator the scope. Then what? Then, inste of the single pattern shown in Fig. we obtain the double pattern shown Fig. 6 with a 60-cycle sweep. It is p sible to work with these two patte if you appreciate how they were p duced. But, unless you have a co plete mastery of alignment techniq it is best to stick to the more nor approach.

Now, it is possible to deflect th beam in the scope sinusoidally wi out making the above-mentioned c nection between the sweep genera and the scope. However, in such i stances, the scope must have things: (1) a means of supplying own 60-cycle sine voltage to its h zontal deflection system and (2) own phase control. Under these con tions, we adjust the scope's phase c trol to obtain a single pattern. We regard the sweep generator's ph control because its 60-cycle voltag not being used. More and more os loscopes are incorporating their o 60-cycle sine wave deflection volta and the corresponding phase contr

Blanking voltages and controls: feature that is finding increasing g in sweep generators is the blank circuit. This circuit, when turned injects a negative pulse into the sw oscillator circuit in such a man that oscillation is stopped for half cycle. This has the effect of remov one of the two traces that is norma produced on the screen. Thus, electron beam in the oscilloscs traces out the response curve of

Fig. 6. Curves obtained when scope uses own saw-tooth sweep instead of 60-c sine-wave deflection voltage of generc





A blanking circuit in a sweep or produces a zero reference line screen of the service oscilloscope.

under test on its first trip he screen. On the return trip, m would normally trace back e same curve. Actually this tracing is not necessary since ides the same information as vious trace. Furthermore, there ally sufficient unbalance exist- the circuit so that the second oes not coincide at all points e first trace, resulting in two at one or more points. Through of the blanking circuit in the generator, the sweep voltage ng the second trace is elimi-

in the scope, however, the s not similarly blanked out and oduces a zero voltage or refer- ie because during this period it ving nothing from the circuit est. See Fig. 7. (The circuit, same token, is not putting out ltage because it is receiving from the sweep generator.) esence of the base line aids the ian in evaluating the various of the response curve and tends to simplify and hasten vicing and alignment process. ro base line proves to be espe- valuable for FM discriminator ent since in this instance the portion of the S-response curve extend for equal distances and below the zero base line.

ost sweep generators containing g, there is simply an "on-off" whereby the blanking voltage e brought into operation or off. In a few instruments, the of blanking voltage may be led, regulating the extent of ble pattern on the screen. Usu- more blanking voltage than is ry should be employed.

entirely possible that the oscil- may possess its own blanking and generally, if one is em- the one on the other instru- should not be. In the oscillo- the blanking control is usually oined "on-off" switch and po- neter. The switch brings the g voltage into the system while otentiometer determines its This control is necessary be- n the oscilloscope the blanking usually applies a sine wave control grid of the cathode-ray This acts to intensify the trace the positive portion of the ap- ine wave and to reduce the in- or blank out the trace entirely the negative half cycle. With of the phasing control, the ap- ine wave (that the control grid cathode-ray tube receives) can be shifted in phase until the undesired portion of the screen trace is blanked out. Without this phase control, it could happen that some or all of the desired portions of the response curve would be blanked out, leaving the undesired or unnecessary sections visible.

It should be noted that while the blanking controls in the sweep generator and in the oscilloscope perform essentially the same function, there is one difference between them as far as the visual pattern is concerned. That is, when the blanking circuit is turned on in the scope, one trace of a response pattern is eliminated but with no reference line produced instead. The reason, of course, stems from the fact that the blanking control voltage here removes the second pattern by cutting off the CRT beam. When the blanking circuit in the sweep generator is used, the beam of the CRT is not cut off and so it is able to produce a base line.

Sweep phase reversal: On one or two sweep generators a sweep reversal switch has been incorporated. What it does is reverse the phase of the 60-cycle sine voltage that is sweeping the frequency of the generator back and forth. The purpose in providing such a switch is to permit the response curve to be presented with the low frequency section of the curve appearing at the left-hand side of the screen and the high-frequency section at the right-hand side. See Fig. 8B.

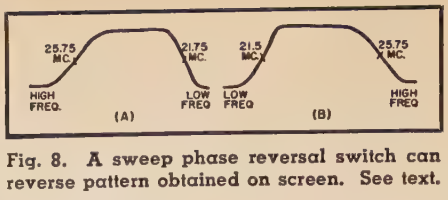


Fig. 8. A sweep phase reversal switch can reverse pattern obtained on screen. See text.

It can happen, because of the manner in which the test equipment is designed, that the response curve obtained on the screen will have the high-frequency section on the left and the low-frequency portion on the right. See Fig. 8A. There is, of course, nothing wrong with this pattern and it may be used during an alignment job. However, response curves are ordinarily shown in textbooks with the low-frequencies at the left and being able to switch a pattern from the form of Fig. 8A to that of Fig. 8B may be helpful to the technician. This is the purpose of the phase reversal switch or control.

It may sound repetitious to note that some scopes possess the same facility, here, too, with the purpose of assisting the technician. Whether or not the technician avails himself of this convenience, when it is present, is purely a matter of personal preference. Some men do not mind working with a reversed pattern; others find it helpful to set the curve up in its more traditional form.

It is interesting to note that if you have an oscilloscope which can supply its own 60-cycle sine-wave deflection voltage, you can reverse the phase of a response pattern *without* a special phase reversal switch. Here is how this is done. Set up the instruments for the alignment but have the scope provide its own 60-cycle sine-wave deflection voltage. Then observe the response pattern on the scope screen and if it is reversed, simply reverse the scope's power plug in the line socket. This will turn the pattern around to the desired form.

Sweep generators with internal variable markers: Sweep generators must always be used with two other instruments: an oscilloscope, of which we have already spoken, and an AM signal (or marker) generator. The scope is needed to present visually the shape of the response curve. Because of the dependence of the sweep generator on the marker generator, the two are often combined. In some instruments, the marker generator is definitely an auxiliary unit, serving simply to provide identification signals in the i.f. range. This, for example, is true of the *Hickok* Model 610A where the marker range is from 19 to 48 mc. In other instruments, the marker generator is a full-fledged partner, being similar to any of the separately contained r.f. television signal generators available on the market. In this category fall the *Jackson, Simpson, Triplett,* and *Philco* instruments. In each instance the AM generator can independently supply r.f. signals ranging from three or four megacycles up to 250 mc. (216 mc. in one instance). This enables these marker generators to develop signals that will cover all of the FM and v.h.f. television i.f. and r.f. ranges.

The advantage of incorporating the marker and sweep generators in one cabinet is, of course, greater ease in combining the marker voltage and the sweep signal. With the instruments merged, we do away with the connecting wires between them. The combination of the two signals is accomplished automatically while the strength of each signal can be independently adjusted for best results. Of course, placing two generators in one cabinet means that you pay for both, although the increased cost is seldom as much as it would be if each generator were packaged individually.

Some manufacturers prefer to keep their marker generators separate from the sweep generator, feeling that this unit is an instrument in its own right. The separate packaging, they say, enables the manufacturer to enlarge the scope of the marker generator for applications, something which is generally not feasible when this unit is combined with the sweep generator. Thus, *RCA* in its marker generator has such extra features as a heterodyne frequency meter with amplifier and speaker, a bar-pattern generator for making linearity adjustments, and a dual-crystal standard with two crystals supplied.

So the instrument you choose depends upon the extent of your needs and how much you feel the equipment should be able to perform.

Sweep Generator Application

The successful application of any test instrument is a twofold affair. First, the controls must be properly set in accordance with the use for which the instrument is to be put. Second, the proper connections must be made between the unit and the test point. In the case of the sweep generator, the second step is frequently the more difficult one. A man may be perfectly able to tell you what each control does and yet get weird patterns on the scope screen (if, indeed, he gets any at all) when the instruments are set up.

In view of this difficulty, let us proceed, step-by-step, through an actual sweep alignment of the video i.f. system of a television receiver. First, the receiver is set up on its side on the bench so that the various i.f. adjustments are accessible. Next, an oscilloscope is placed beside the receiver and a lead is run from the video second detector load resistor, through a 10,000-ohm isolating resistor, to the vertical input terminal of the oscilloscope. Also, the ground post of the scope is connected to the chassis of the receiver. See Fig. 5.

(Here is the first point where trouble can be encountered. Make certain the connection is made to the load resistor of the video second detector. It is generally not advisable

the video amplifier system for
onnection because in many sets,
sponse to 60 cycles is only fair.
the response curve has a 60-
epetition rate, a poor response
frequency can seriously affect
ape, *i.e.*, the tilt of the curve.)
sweep generator is brought in
Connection is made from the
tor output to the grid of the
stage. In the widely-used *Stand-
il* tuner, for example, there is
ial terminal available to which
onnection can be readily made.
er tuners it may be necessary
ke contact directly with the
grid terminal on the tube sock-
this point is difficult to reach,
ernative method is to lift the
on the mixer tube and connect
eep generator signal lead to it.
ing the shield sideways slightly
be made to rest on the glass of
be. If this is done carefully, the
will be supported by the tube
pe and hence prevented from
ting the chassis and grounding
gnal.

complete the generator connec-
o the set, a wire is run from
ound terminal of the instrument
receiver chassis.

next step is to bring some of
enerator's sweeping voltage to
orizontal input terminals of the
scope. The thing to watch out
re is the proper setting of the
controls. Just making the inter-
ction between the two instru-
is not enough, for unless the
is set up to receive this deflec-
oltage, the beam will continue
driven by the saw-tooth voltage
ped internally by the scope. So
s another possible trouble point.
ore the equipment is placed in
tion, the receiver oscillator must
sabled to keep it from feeding
oltage to the mixer during the
nent period. Without doubt, this
aused more confusion than any
single item.

are almost ready to go, but one
preparatory step remains. The
g of the bias on those stages
re a.g.c. controlled. Most manu-
ers recommend a value of —3
and this can be obtained from a
ate bias supply or from a couple
shlight batteries.

power is now turned on and
quipment is permitted to warm
Set the sweep generator to the
alue of the frequency range to
vered; adjust the sweep width
ol to a value of from 5 to 8 mc.
a video i.f. system). Generator
t is initially turned to its maxi-
position. On the scope screen,
sort of indication should be ob-
d. Initially, this will most likely
louble pattern, of the type shown
g. 4B. Adjust the phase control
a single pattern is obtained. If
ing of the second trace is de-
now is the time to do it. Make
he signal is not overloading the
i.f. stages; this can be checked
e following simple test. Rotate

the output control on the sweep generator. If the video system is not being driven too hard, the amplitude of the curve will vary in step with the rotation of the output control.

The final step in this alignment setup is the introduction of the marker signal. However, never take this step until the response curve itself has been obtained. In this way, swamping of the response curve (which can readily occur) will be immediately apparent. Also, by following the foregoing sequence, the number of different variable factors that you have to deal with at one time is reduced, thereby lessening the number of possible sources of trouble. A slow, methodical approach is always the fastest way to carry out a sweep alignment, especially when the equipment is not completely familiar to you.

The foregoing discussion, of necessity, was kept brief. However, the most important obstacles were pointed out and if the proper precautions are observed, no major difficulty should be encountered. Remember: Never do too many things at one time; introduce each step in turn and you will seldom find yourself lost.

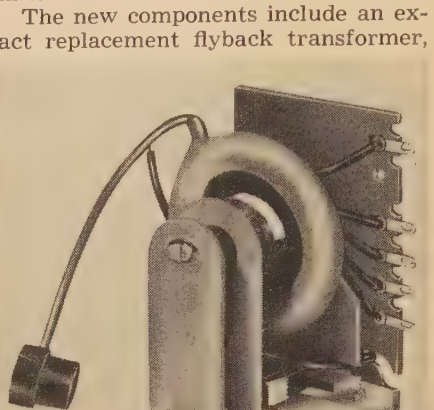
From the points outlined in this article it is easy to see why the television sweep generator is such a valuable adjunct to the test bench equipment for the technician. Its proper use can speed service jobs and result in a more profitable operation. —30—

NEW TV PRODUCTS on the Market

REPLACEMENT PARTS

The *Standard Division* of *Chicago Standard Transformer Corporation,* Addison and Elston Avenues in Chicago, has released five new TV replacement components in the *Stancor* line.

The new components include an exact replacement flyback transformer,



A-8137, duplicate of the *Hoffman* #5035 used in 25 *Hoffman* models and chassis; and the A-8126, universal *Philco* replacement vertical blocking oscillator transformer. The A-8126 can be used in all *Philco* TV models and chassis built up to the spring of 1953.

Two width controls, WC-1 and WC-4, and a tapped linearity coil, WC-2, have also been added.

Bulletin #468 listing specifications and replacement information on these units is available from *Stancor* distributors or from the company direct.

NEW TV ANTENNAS

General Antenna Mfg. Co., 1652 Rockwell Ave., Cleveland 14, Ohio is now offering a new u.h.f. antenna which is said to be effective up to 50 miles, depending on local conditions. The 500-U is described as covering all u.h.f. stations, having low vertical radiation angle, low standing-wave ratio, and 300-ohm terminal impedance. The antenna is all aluminum and heavily constructed.

Television Hardware Mfg. Co., 919 Taylor Avenue, Rockford, Ill. is now introducing an indoor u.h.f. antenna which performs well when within range of the TV station or where an indoor antenna is practical for u.h.f. reception. This "UHF Butterfly" is designed to be placed on top of the set for use on any channel from 14 to 83.

Trio Manufacturing Company, Griggsville, Ill. has made a radical improvement in its line of "Zig-Zag" antennas which boosts performance on every channel. The improvement is accomplished by the use of a new re-entrant network which provides a most perfect impedance match t line on every channel. Current ments of these antennas will in the re-entrant network and a ph harness for use when stacking models for all-channel, single feed operation.

Wells & Winegard, Burlington, has introduced the Model CP-1 " per" to its line. The "Clipper," a gain fringe area unit engineered complete coverage of all v.h.f. nels, offers high uniform gain, ohm match, one major forward lo narrow beam to reduce ghosts noise pickup, and high signal-to- ratio. Details are available from manufacturer.

PORTABLE TOWER

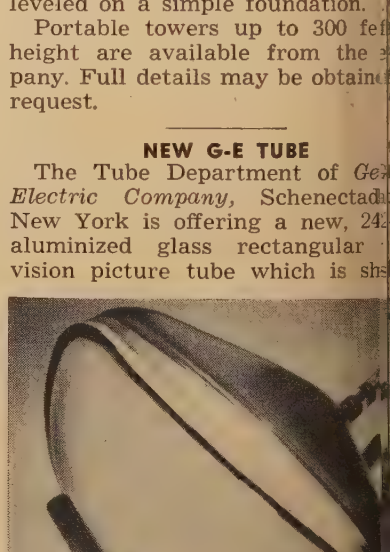
A new portable tower of alum alloy is currently being marketed u.h.f. communications applicatio *Up-Right, Inc.* of 1013 Pardee, B ley, California.

The tower is built by setting in ual sections one on top of the o Of patented one-piece constru each folding section is assembled out tools. Innovations in the g systems eliminate the use of buckles, cable clips, and other hardware. The base may be ra leveled on a simple foundation.

Portable towers up to 300 fe height are available from the pany. Full details may be obtain request.

NEW G-E TUBE

The Tube Department of *Ge Electric Company,* Schenectad New York is offering a new, 24 aluminized glass rectangular vision picture tube which is sh



than most 21-inch glass rectan tubes available today.

The Type 24CP4-A has a defle angle of 90 degrees, a major fac making it shorter than standar

es of the same type. It meas-
y 21⅛ inches over-all.
ube's aluminized screen is said
ase light output and picture
. It also incorporates a high-
gray faceplate to improve pic-
tail under high ambient light
ns. The tube operates with
c focus and deflection and in-
tes an external conductive
which is used as a filter con-
when grounded.
mmended operating conditions
an anode voltage of 16,000
grid 2 voltage of 300 volts, a
voltage of from −33 to −77
focusing coil current of 119
d an ion trap intensity of 40

ompany will supply further de-
request.

TUBE "BRITENER"

a-Power Company, 4727 North
Ave., Chicago 25, Ill. is mar-
a new tube "Britener" for use

elevision tubes having either
l-wired or series-wired heaters.
unit relieves cathode heater
problems, its isolating type
rmer giving normal 6.3 volts to
ater to relieve the cathode
roblems or 7.8 volts to increase
e emission and restore lost
ess. A simple switch allows se-
of the correct voltage.
trated literature on the "Uni-
TV Tube Britener" is available
uest.

TV BOOSTERS

burne Manufacturing Co., Inc.
Radford Place, Yonkers, New
now offering a new i.f. signal
for u.h.f. and v.h.f., the Model

unit, now available at parts dis-
rs, provides an extra stage of
mplify both u.h.f. and v.h.f. sig-
ithout switching. The booster,
is supplied in adapter form, is
d in an existing tube socket
quires but one wire connection
nd.

TESTING YOKE

ew magnetic deflection yoke
cuts production time in testing
e-ray tubes is now available
yntronic Instruments, Inc., 100
ial Road, Addison, Illinois.
rding to the company, from
to 250,000 tubes may be con-
ly tested without yoke damage
re. The yoke is unconditionally
teed for one year.
age to the yoke from the tube's

prongs is prevented by the smooth, heavy-walled bakelite lining in the yoke's center and by the stainless steel funnel. Loading is made easier by a special funnel design and the ample internal neck diameter. Tubes slide in and out quickly and easily for continuous testing.

The company will supply full details to interested manufacturers.

DAMPER DIODE

A completely new damper diode, 6AU4GT, designed for use with large screen 90 degree deflection picture tubes is in production at *Tung-Sol Electric Inc.*, 95 Eighth Ave., Newark 4, N. J.

The wider deflection angles and the increased second anode voltage required to maintain picture brightness call for higher deflection power and increased circuit efficiency. The 175 ma. rating of the *Tung-Sol*-designed and developed 6AU4GT is more than adequate, with ample safety factor, for these new designs.

Complete technical data is available from the company on request.

PLASTIC SPRAY

Acrolite International, Dept. T-3, Hillside, New Jersey, has released a new plastic protective coating for radio and television service work.

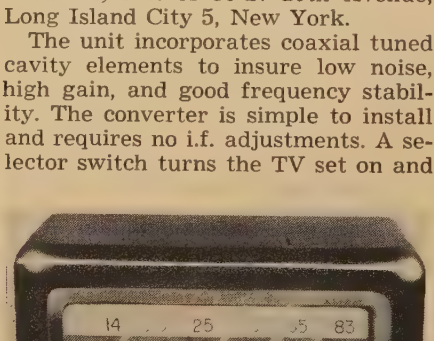
This heavy-duty acrylic plastic is compounded to insulate, waterproof, and stop rust and tarnish. The coating is packaged in a spray bottle. A press of the button and the spray may be applied directly to the part to be treated.

Free literature on additional uses for this product will be sent by the company on request.

U.H.F. CONVERTER

A low-cost u.h.f. all-channel television converter, the "Star," is now being offered to the trade by *Granco Products, Inc.* of 36-17 20th Avenue, Long Island City 5, New York.

The unit incorporates coaxial tuned cavity elements to insure low noise, high gain, and good frequency stability. The converter is simple to install and requires no i.f. adjustments. A selector switch turns the TV set on and



off and provides instant changeover between u.h.f. and v.h.f.

The converter is housed in a mahogany plastic cabinet. It uses a 6AF4 oscillator tube, a 6CB6 i.f. amplifier

nd a crystal mixer. It is shipped o install and operate at 117-120 0 cycles a.c.

ALSCO U.H.F. CONVERTER

co Electronics Corporation, Los s 18, California is now in pro- on a new u.h.f. converter for the company claims outstand- formance.

new unit, which has been trade- the "Imperial," features an ex- new turret-type bandspread ith a double-tuned preselector.

"Turretune" feature provides a nt *LC* ratio.

"Imperial" covers the entire frequency spectrum from 450 to c. It has perfect tracking on than eight points for maximum and lowest noise figure. A "bal- line" oscillator keeps frequency to a minimum. Input antenna nals are provided for separate and v.h.f. antennas but can be with combination antennas.

COAX TUNED ELEMENTS

nco Products, Inc., 36-17 20th ue, Long Island City, 5, New now has available two types of coaxial tuned elements.

Model UHO is an oscillator ele- with a built-in 6AF4 tube. The UHR is a preselector element. models incorporate resonant cav- ning which features a moving er permitting coverage of the u.h.f. television band. All ele- are completely wired and .

CR TUBE ADAPTER

erex Electronic Corporation, 23 ton Street, Yonkers, N. Y., is ntly marketing a picture-tube er that can be used with any of tube tester and all picture

end of the adapter plugs into ube tester and the other end into the picture tube without ving the tube from the cabinet. tube, electrostatic or magnetic 10" to 30", can be checked for de emission, shorts, etc.

PORTABLE ANTENNA

der Manufacturing Company of delphia 40, Pa., is currently mar- a new portable television an- for u.h.f. and v.h.f. reception. denamed the "3D," the new an- covers all channels from 2 to 83 ffords maximum adjustments to take advantage of weaker-than-normal indoor signals. With two 3-section, gold tone brass staffs, the antenna features the company's "Directronic" 6-position beam selector which uses a new criss-cross phasing element in a variety of circuit arrangements. This helps to provide proper impedance matching, orientation, and ghost elimination.

A catalogue describing this and other antennas in the company's line is available from the firm on request.

24-INCH PICTURE TUBE

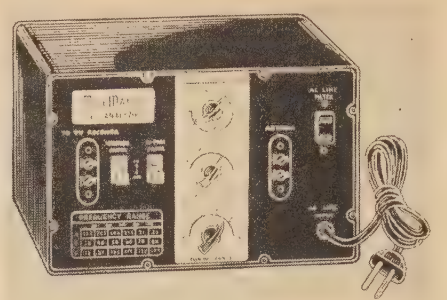
National Union Radio Corporation, Hatboro, Pennsylvania is in production on a 24-inch rectangular picture tube, the Type 24C/VP4.

The new tube is magnetically deflected and magnetically focused and employs a tinted gray faceplate. Minimum over-all length is achieved through the use of a 90 degree deflection angle. Picture size is approximately 17¼" x 21¾". The tube is rated for operation with second anode potentials up to 18 kv. Typical operation calls for 300 volts on G2 and 17 kilovolts on the second anode.

TVI ANALYZER

A TVI analyzer, which has been designed to identify interference signals to speed servicing, is now in production at *Tele-Matic Industries, Inc.,* 1 Joralemon Street, Brooklyn 1, New York.

The analyzer contains a high-pass and ignition filter section, an a.c. line



filter section, and a full range of calibrated wave traps. The desired wave trap is selected by a rotary switch and tuning is accomplished with two calibrated selector knobs.

"NO-GAB" CONTROL

One answer to the complaint of over-long commercials is being offered by *Franklin Sales Company,* 2149 West Washington Boulevard, Los Angeles 54, California.

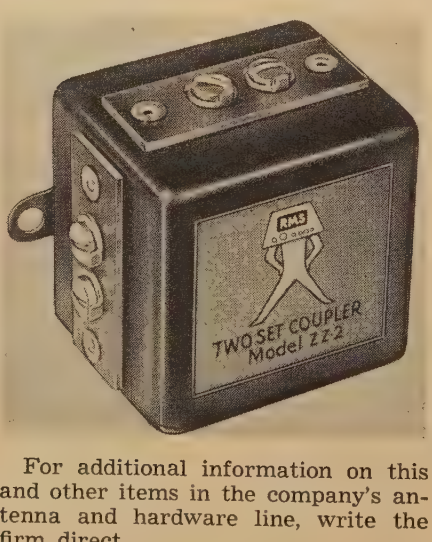
Known as "No-Gab," the device cuts off unwanted sound but lets the picture continue in a normal manner. The device may be attached to the set in 3 minutes. It can be operated from any point in the room.

Additional details on this unit will be supplied by the manufacturer on request.

TWO-SET COUPLER

Radio Merchandise Sales, Inc., 2016 Bronxdale Avenue, New York 60, N. Y. has added a two-set coupler to its line of antennas and accessories.

Known as the Model ZZ-2, this pigmy-size, low-cost coupler employs an iron-core network and transfers maximum signal from the antenna to both sets. Hardware for mounting the coupler is supplied with each package.



For additional information on this and other items in the company's antenna and hardware line, write the firm direct.

TELCO ARRESTER

Television Hardware Mfg. Co. of Rockford, Ill., a division of *General Cement Mfg. Co.,* is now offering a new *UL*-approved lightning arrester for both indoor and outdoor use.

ew *"Telco"* unit has no lugs to nd no wires to strip. It will on a wall with two screws or s and masts with a strap. ogued as part No. 8642, the t comes complete with mount- ps and screws. It is available distributors or additional in- n may be obtained by writing npany at 919 Taylor Ave. in d.

H.F. SWEEP GENERATOR

London Instrument Co., P.O. , New London, Conn. has an- the availability of its Model f. sweep generator.

ring single-range tuning and a sweep width, the unit is de- for either laboratory, produc- service use.

so features at least one volt in 75 ohms, continuously vari- tenuator, a blanked signal on urn sweep to provide a refer- se line, no beating, no multipli- and simplicity of operation. A t balun is available for con- to 300-ohm load.

U.H.F. TRIMMER

Manufacturing Company, Inc., xteenth Ave., Brooklyn 4, N. Y. oduction on a "Mighty Midget" ype variable trimmer conden- odel VC3-G for u.h.f. television nufacture and replacement re- ents.

trimmer measures 1" over-all imum capacitance. The capaci- range is 1 to 8 $\mu\mu$fd. The uni- mounting design fits any u.h.f.

—30—

ison Radio Amateur Award which given by General Electric Company ebruary to the amateur judged to performed the "outstanding public of 1953," is inspected by, left to George E. Sterling, FCC commissioner e of the award judges; G. A. Brad- dvertising manager of the company's Department; and Goodwin L. Dos- ARRL president and another award Other judges are E. Roland Harri- resident of the American Red Cross ardner Cowles, editor of "Lock."

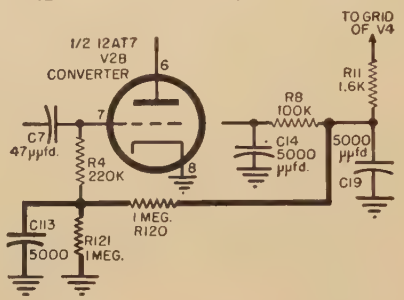
SERVICE HINTS ON G-E TV SETS

810, 811, & 814

Buzz in audio.

This may occur in strong signal areas because the peaks of the signal, which are the vertical pulses, cause the converter grid (V_{2B}, ½ 12AT7) to draw grid current which, in turn, frequency modulates the oscillator voltage at vertical pulse rate of 60 cps.

To remedy this, add bias to the converter grid (pin 7) by the addition of R_{120} and R_{121}, 1-megohm, ½-watt resistors, and C_{113}, a



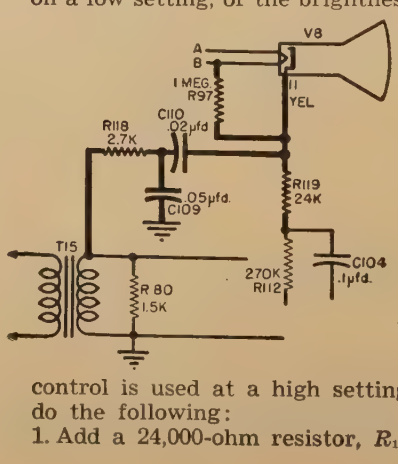
5000-μμfd. ceramic condenser, as shown in the accompanying diagram.

Proceed as follows:

1. Add a terminal board to the underside of the main chassis near the r.f. unit. This board should be mounted so that short leads can be used.
2. Remove R_4 from ground under the oscillator trimmer, C_{80}, and connect it to the junction of R_{120} and R_{121} on the new terminal board.
3. Connect C_{113} from the junction of R_{120} and R_{121} to the ground point on the r.f. chassis under the oscillator trimmer, C_{80}.
4. Dress C_{113} as far away as possible from the oscillator trimmer, C_{80}.

Vertical retrace lines visible.

If vertical retrace lines appear when the contrast control is used on a low setting, or the brightness



control is used at a high setting, do the following:

1. Add a 24,000-ohm resistor, R_{119}, between the junction of R_{112} and pin 11 of the CRT. (See accompanying diagram.)
2. Add resistor R_{118}, and connect C_{109} and C_{110}, as shown in the diagram, between pin 1 of the CRT and vertical sweep output transformer secondary.

811, 814, 820, 830, & 835

Click in speaker as tuning control is adjusted.

This is an indication of a regeneration, and can be eliminated by connecting a 500-μμfd. ceramic condenser across the radio i.f. "B+" lead. This correction is made on the terminal board located between the 6th limiter tube socket, V_{18}, and the discriminator transformer. The condenser is connected between the "B+" and ground terminals at this terminal board.

814

Wiggle at top left of picture.

To remove this effect, add a 1-megohm, ½-watt resistor in parallel with C_{83}, the .5-μfd. paper condenser from horizontal size control to horizontal deflection coil.

818

Flutter on strong TV signals.

This appears as intermittent loss of the picture brilliance of a few cycles duration, similar to airplane flutter, at very strong signal strength which requires minimum setting of contrast control.

To correct this condition change C_{255} in the grid circuit (pin 1) of the 6AU6 first i.f. tube, from a .05-μfd. to a .5-μfd., 200-volt paper condenser.

Also change R_{280} in the grid circuit (pin 1) of the 12AU7 video amplifier tube from a 1,000-ohm resistor to an 18,000-ohm ½-watt unit.

17T10, 17T11, & 17T12

Picture height varies with change in brightness control setting.

To eliminate this condition remove R_{289}, the 150,000-ohm resistor from the cathode (pin 1) of the CRT to the brightness control. Replace it with a 220,000-ohm unit.

Compression on top of picture.

To eliminate this, remove the 82,000-ohm resistor, R_{330}, in series with C_{318}, .002-μfd. condenser across the vertical output transformer, and replace it with a 1,000-ohm unit.

Horizontal instability.

To improve the horizontal sy

se receivers, remove R_{279}, the),000-ohm feedback resistor, nnected from the grid (pin 4) V_{13B}, the 6SN7GT horizontal illator tube, to the plate (pin of V_{12}, the 6AL5 discriminator. place it with a 330,000-ohm it.

7T11, 17T12, & 21T2

or vertical linearity.

improve the vertical linearity, ange the vertical output tube ($_{10}$) from a 25L6GT to a W6GT. These tubes are inter-angeable, and no wiring change necessary.

0C105, 20C106, & 21C200

ght picture with black lines.

his may occur when C_{375}, the .1-d. condenser in the grid circuit pin 2) of the picture tube is horted. If this is the case, the cture control, R_{284}, will not ork. Replace this condenser if fective.

m picture, insufficient width and height.

heck C_{377}, the .5-μfd., 200-volt aper condenser, between the orizontal deflection coils and erminal 6 of T_{352}, the horizontal utput transformer. Replace this ondenser if defective.

) & 24C101

xcess contrast in picture.

his is indicative of circuit over-oad, and is primarily due to a oss of a.g.c. control by the 6AU6 eyer tube.

To improve the a.g.c., increase he screen voltage on the 6AU6 eyer tube by replacing the U4GT's. The latter may be giv-ng low emission, resulting in de-reased screen voltage to the eyer.

TRATOPOWER "E" & "EE" CHASSIS

Weak or critical audio tuning.

This may be caused by poor grounding of the shield on the CB6 audio i.f. tube (2nd tube rom the back in the center strip n the chassis).

road black vertical bar on left half of raster.

This may be due to an open tap n the high-voltage horizontal utput transformer (tap 8 on "E" hassis transformer only).

This may also occur when the oupling condenser from the vidth control to pin 7 of V_{116B}, the 2AX7 horizontal blanking tube, s open. This condenser is C_{381} on he "E" chassis, and C_{388} on the EE" chassis.

ntermittent operation.

ntermittent operation may be lue to pin 1, of the 6AK5 second .f. tube, shorting to the shield irectly below the socket. Rock-ng the 6AK5 will reveal whether his is the cause of the intermit-ent condition.

To cure this condition, clip bout 1/16" off pin 1 on the 6AK5 ube, and re-insert it in its socket.

—30—

Modernizing TV Sets

(*Continued from page 79*)

your set, particularly the noise which is generated in the first few stages. By adding a booster to a television receiver, we essentially cause the noise figure of the booster to become the representative noise figure of the combined booster and receiver.

Why? Because, the noise generated in the receiving system is important only when it is on a par with the incoming signal. This is true only in the first stage or two. If you add a booster to your set, then it is the booster that receives the signal first and so it is the booster noise that is important. At the output of the booster the signal has already been amplified 4 or 5 times and now it is strong enough so that the receiver noise (in its r.f. amplifier stage) is dwarfed by the strengthened signal and can be more or less disregarded.

To show what a good booster c do, examine the figures given Table 2. Here are shown the f figures of the average 1950, 1951, 1952 television receivers for t low- and three high-band v.h.f. c nels. Note again the improvem through the years, moving down f 11.5 db on Channel 2 in 1950 t db on Channel 2 in 1952.

Now look at the noise figures w these same average receivers are in combination with a booster w itself has a low noise figure. The sults on all three sets, on all chan is better than the noise figure f 1952 set by itself. Here is a demons tion of how much the performanc every television receiver can be proved by adding a good booster if you have a set whose perform can be improved, try a booster. a well-designed and well-constru unit you, too, may be able to go the picture shown in Fig. 2 to the shown in Fig. 3.

—30—

RARE TV TROUBLE

By RICHARD BLITZER
Tele-Video Associates

EVERY now and then a fault occurs in a television receiver that seems, at first, to have no relation to the symptom. For example what would you think of a split-sound receiver where an inoperative video amplifier, not an i.f. stage, produced *no sound* as well as, of course, no picture. This fault occurs in RCA receivers using directly-coupled video amplifiers and directly coupled a.g.c. tubes.

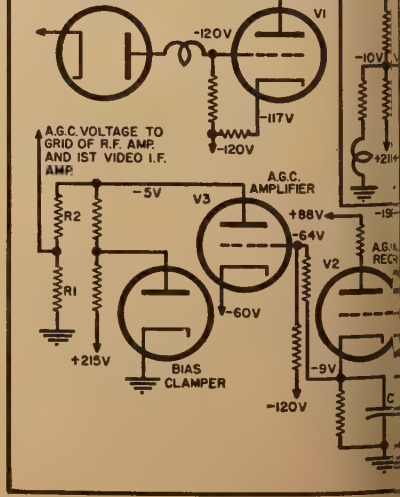
By referring to Fig. 1 we can explain this strange occurrence as follows: First let us see how the circuit operates normally. The detected video signal is applied to the grid of V_1, the 1st video amplifier. The amplified signal is taken from the plate and fed to the 2nd video amplifier (not shown). This same signal is also applied to the grid of V_2, the a.g.c. rectifier. The amplitude of the signal determines the tube's conductivity. The output of V_2, taken off the cathode, is a filtered d.c. voltage, due to C_1, and contains no traces of video signal. Plate current of V_2 determines the d.c. voltage at the cathode. This negative d.c. voltage is applied directly to the grid of V_3, the a.g.c. amplifier. Plate current of V_3 produces a negative voltage, the a.g.c. voltage at the junction of R_1 and R_2, which is used as bias for the r.f. amplifier and 1st video i.f. amplifier.

Stronger stations result in larger video signals fed into V_2, the a.g.c. rectifier. Heavier conduction of V_2 makes its cathode output voltage, and the grid of V_3, less negative (or positive-going). V_3, the a.g.c. amplifier, conducts more heavily, driving its plate voltage, and the a.g.c. voltage, more negative. The gain of the a.g.c. biased r.f. and i.f. amplifiers are thus decreased, preventing overloading and distortion on the stronger stations.

If V_1, the 1st video amplifier, to get back to our original trouble, becomes inoperative, its plate voltage would go positive from its normal value of about —19 volts. This would cause V_2, the a.g.c. rectifier, to increase conduction. Its cathode would likewise go positive, or less negative, than its normal value of —9 volts. V_3, the a.g.c. amplifier, would now have its grid going less neg than its normal value of —64 volts, resultant increase of plate current. plate voltage of V_3, and the a.g.c. age, would now be driven so neg that both the r.f. and video i.f. ar fiers would be cut off. Picture sound both disappear in the receive

Usually, when the technician sees a symptom, he suspects those s which handle both picture and sound the split-sound receiver these, of co are the "front end" stages and any v i.f. amplifiers which also pass sound signals. When a receiver has a.g.c most do, then these stages should come under suspicion. Measuring a.g.c. stage voltages would, in this ticular trouble, show them up as ab mal. Only when these voltage mea ments were followed back to the video amplifier plate would the te cian begin to suspect this stage as t the cause of lack of sound.

Fig. 1. Simplified, partial schema of an RCA receiver using directly-coupled video amplifiers and a.g.c. stag



Within the Industry

(*Continued from page 30*)

and engineering activities . . . *Sylvania Electric Products Inc.* has named **EDWARD P. ATCHERLY** to the post of merchandising manager of renewal tube sales. He will headquarter in the New York office . . . **HARRY GOODSTEIN** has been appointed manager of the precision control division of *Clarostat Mfg. Co., Inc.* He has been with the firm since 1944 . . . *CBS-Columbia* has named **BERNARD M. DOVER** to the post of project engineer. He joins the firm from *Emerson Radio & Phonograph Corp.* where he headed the tuner engineering department . . . **REAR ADMIRAL THOMAS F. HALLORAN, USN** (ret) has been named general manager of the *Blair Associates Transistor Development Laboratory* in Cambridge, Mass. . . . **JEROME J. KAHN,** founder and president of *Standard Transformer Corporation* from 1930 until its recent merger with *Chicago Transformer Corp.,* has announced his withdrawal from active management in the newly-formed *Chicago Standard Transformer Corporation . . . The Andrew Corporation* has appointed **ROBERT P. LAMONS** to the post of sales manager with headquarters in Chicago. He joined the company in 1945 . . . **HUGH J. DALY** has returned to *Eicor, Inc.* as sales manager of the tape recorder division. He was with the firm 1946-1948 . . . *DeJur-Amsco Corporation* has appointed **GEORGE WEINMAN** to the post of director of industrial and government sales. He will handle the company's line of potentiometers, panel instruments, and electrical connectors . . . **THOMAS W. MASSOTH** has been named to the newly-created post of operations control manager of the Engineering Products Department of the *RCA Victor Division.* He has been with the firm since 1930 . . . **DOUGLAS CARPENTER** has been named chief antenna development engineer of the *JFD Manufacturing Company Inc.* of Brooklyn. He was formerly chief engineer for the "Vee-D-X" division of *LaPointe Electronics,* the *Summit Engineering Company,* and *McMurdo Silver Company,* all of the Hartford, Conn. area . . . **JOHN W. HINES** has been named director of sales of *Magnecord Inc.,* Chicago manufacturer of professional magnetic tape recording equipment. He succeeds **C. G. BARKER** who resigned . . . **RICHARD H. DORF,** audio consultant, has been named editorial director of *Electronic Handbook Company* of 255 W. 84th St., New York City.

* * *

NATA of Seattle, Washington, is holding its first annual "Profit Clinic" at the Norseland in Seattle September 27th and 28th.

The Northwest Appliance & Television Association has obtained the services of several well-known speakers who will address the meet. Included

are Kip Anger, national promotion manager of *Motorola, Inc.;* Mort Farr, past-president of NARDA; A. W. Bernsohn, managing director of NARDA; and Wallace Johnson, president of NARDA.

Those wishing additional information about the "Clinic" are invited to write Ed Smith, executive secretary of NATA, 714 American Bldg., Seattle 4, Wash.

* * *

GEORGE B. FRASER has been elected president of *The Astatic Corporation,* Conneaut, Ohio. He was formerly vice-president and general manager of the firm. He has served as treasurer since he joined the company in 1936 and retains this title along with the top post.

Mr. Fraser was made assistant general manager in 1944 and vice-president and general manager in 1950.

He is the third *Astatic* president since the company was established in the early thirties. Floyd W. Woodworth, one of the founders, was president until his retirement in 1950.

* * *

RUFUS P. TURNER, a regular contributor to RADIO & TELEVISION NEWS, has been awarded the honorary degree of Doctor of Science by Golden State University in Hollywood in recognition of his contributions to radio literature and his simplification of electronic test instruments.

Mr. Turner will serve as a visiting lecturer at the college during the current school year.

* * *

JOHN T. CAVIEZEL has been appointed manager of the television sales section of the *Crosley Division* of *Avco Manufacturing Corporation.*

He joined the company in 1951 as sales promotion manager in the Kansas City zone. He later was made zone manager of electronics in Kansas City and for the past year has been manager of new market development for television, working out of the central office of *Crosley* in Cincinnati. He will be succeeded by DeWitt Suplee, who has been in charge of the new market development program in the Eastern division.

* * *

INTERNATIONAL RESISTANCE COMPANY of Philadelphia has started construction of a plant located in Boone, Watauga County, North Carolina. The plant, to be situated on a 20 acre tract will provide 40,000 square feet of work space. The plant is the company's second to be located in North Carolina . . . **GATES RADIO COMPANY** has opened a new office and stock distributing warehouse at 7501 Sunset Boule-

Los Angeles, California. Robert is in charge of the new opera- . . . **HUDSON RADIO & TELEVISION** with headquarters at 48 West Street, New York City, has opened salesroom in Newark, New Jer- at 35 William Street. The new oom will feature a complete of radio and electronic compo- and sound equipment.

* * *

ON K. ULRICH has joined the *Da- ogen Company* as general sales ger, replacing Walter Jablon has resigned he company's -president in e of sales.

Ulrich, for- renewal sales ager of the *Na- l Union Radio oration,* brings to his new posi- an unusual combination of sales engineering experience. He is a uate of MIT and served as commercial engineer for *CBS- on.* He is a director of the Radio s Show, a senior member of the a member of the AIEE, and a ber of the Radio Club of America.

* * *

IP S. RAND, a project engineer at *Remington-Rand Laboratory of nced Research* in South Norwalk, ., has been awarded the ARRL's rit Award" in recognition of his ancement of the welfare of ama- radio through outstanding lead- ip and technical accomplishment duction of TV interference."

r. Rand has done extensive re- ch in the field of TVI elimination several years from his home in ding Ridge, Conn. His call is BM. —30—

PHOTO CREDITS

	Credit
122	Walter Ashe Radio Company
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	Skiatron Electronics & Television Corp.
64, 66, 152, 154, 180, 209	General Electric Co.
79	Regency Div., I.D.E.A., Inc.
	The Radio Craftsmen, Inc.
	Allied Radio Corporation
	Mohawk Business Machines Corp.

ERRATA

the parts list accompanying Fig. 2, page of the July issue ("125-Watt Audio System Clipping") the value of T_4, the modula- plate transformer, was omitted. Any plate sformer delivering 1000 volts d.c. at 250 may be used.

* * *

the third column of the article appearing page 49 of the August issue ("Trouble- oting TV High-Voltage Supplies") the fol- ing sentence appears: "If an arc is ob- ed, touch the screwdriver to the plate of the horizontal output tube." This uld read "If an arc is NOT obtained . . ."

* * *

wo of the dimensions given in the side of the Electro-Voice "Regency" (page 51 ne August issue) are incorrect. The 5¾" ension shown in the lower right-hand cor- of the diagram should be 8⅛" while the dimension at the lower left should be . These dimensions are not critical and be varied ± 10% without affecting per- ance.

INDEX OF Advertisers

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.